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TOWN SCAVENGING AND REFUSE DISPOSAL.

SPECIAL STREET CLEANING SERVICES.

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DAY Service on Roads.—During the day time street orderlies are employed in most large towns to collect the paper and other matter which is continually being deposited upon the road surfaces. These are drawn to the roadside and collected either in specially provided street orderly bins or in small hand carts. In many of the London boroughs, where the whole of the ground beneath the pavement is occupied by service pipes of various descriptions, the bins are constructed of galvanized iron, and are stood in convenient positions on the sidewalks; collecting carts are sent around to empty them as often as they are able, having regard to the interference caused by the traffic. They are generally emptied about three times a day.

In the city of Westminster, in Glasgow, and in many other provincial towns, the orderly bins are placed underneath the sidewalks, removable covers being provided for emptying them. The bins have an outlet to the sewers, which is guarded by means of a grating to prevent solid matter from escaping, and also by having a perforated basket placed immediately over the opening.

Water carts are sometimes employed having a single jet which plays upon the refuse that has been collected in the gutters, and so conveys it to the bins, the water passing away into the sewers. Small hand carts are also very often used.

In the outlying metropolitan boroughs, such as Kensington, and in many provincial towns, hand carts are relied upon entirely, the street orderly boys sweeping the refuse up into heaps, when the barrow men come around and remove them to some quiet part where they can be transferred into the collecting carts. The boys are usually provided with scrapers and brooms in dry weather, and with "squeegees" in wet weather.

The hours worked and the number of boys required for any length of street vary in different districts, depending upon the nature and amount of the traffic on the roads. In the metropolitan borough of Finsbury they they come on duty about 8 a. m. and work until 6 p. m. In the city of London they are employed from 7:30 a. m. until 5 p. m. in summer and 4:30 p. m. in winter. In Leeds the hours are from 7 a. m. till 4 p. m.

In those metropolitan boroughs in the neighborhood of the city proper three orderlies are employed per mile of 30-foot road, but in outlying districts, on roads subject only to ordinary traffic, one per mile would probably be sufficient.

The orderlies are rarely employed on Sundays, the roads generally being left after the night or early morning sweeping has been accomplished, as the case may be.

Street Watering.—Street watering is almost as important as the daily cleaning of the streets themselves, on account of the amount of dust created by the wear and tear of the street surfaces, and this has increased much of late years owing to the introduction of motor traffic. The only surfaces which are not usually watered for their entire width are wood pavements, which are rendered dangerous for some time after the application of the water, both to horses and to cyclists. If they are watered then it is necessary to shingle (sand) the streets immediately afterward in order to give a foothold to horses. As a rule, however, if the streets are properly cleaned by flushing or with rotary ma-

chine broom each night, or in the early hours of the morning, there will be no necessity to do anything further to them. All other kinds of surfaces, however, will require to be watered in dry or dusty weather, and this frequently has to be done in the main roads of our larger cities as often as four or five times a day.

The watering can be performed either by means of motor water vans or by horse-drawn vehicles. The former have been in use for some time in the city of Westminster, and have given entire satisfaction. A petrol (gasoline automobile) water van with rubber tires on all wheels has also been tried, and it has proved most useful, on account of the fact that it can move at the same rate as the fast traffic, so that no obstruction is caused by its use. A water cart has also been attached to a small motor, and used for street watering purposes in Liverpool, where it has been found very satisfactory. Horse-drawn vehicles are more generally used in the London metropolitan boroughs, the areas of which are small in comparison with the area covered by many of our larger provincial towns. The carrying capacity of the carts varies from 300 to 450 gallons, depending upon the nature of the district. The water is drawn from special standpipes, and is measured by meter. In some seaside towns salt water is used for the watering of the streets, and is generally considered to be more lasting in its effect, while it also has a disinfecting influence.

Where ordinary water is used a disinfectant of some description is generally added to it. This either takes the form of Sanitas or Kuna-pine blocks, or a weak solution of either carbolic or permanganate of potash. The Sanitas blocks cost one shilling (25 cents) each, and one will generally be sufficient for about 2,000 gallons of water.

The methods which have been in use at Poplar for the past two or three years for producing a cheap and at the same time powerful disinfectant by electrolytic means are worthy of attention. Dr. Alexander, the medical officer of health, in his annual report for the year 1908, points out that this electrolytic disinfectant has been prepared under his own supervision during the last three years, during which time no other disinfectant has been used for road watering or for other purposes in the borough. During the year 1908 28,280 gallons of the fluid were manufactured, the cost being only 56 pounds ($280). Dr. Klein, bacteriologist to the local government board, has certified that one ounce of the fluid to 150 ounces (nearly one gallon) of water will kill the cholera germ in 2½ minutes. Experiments have shown that, diluted 200 times, this disinfectant forms a suitable and effective solution for road watering, and it is probable that being so much more active than those generally in use, and its production being a simple and inexpensive matter, this electrolytic disinfectant will be much more used in the future for road watering and similar purposes. Chlorine has also been used as a disinfectant. Specially made jars are fixed in the vans which allow the solution of chlorus to escape gradually.

Various forms of patent sprinklers are in use, the simplest of which consists of an ordinary perforated iron tube. Others are fitted with valves which enable the driver to regulate the width of spray and the volume of water distributed. A very convenient sprinkler is used by the corporation of Bristol. This consists of a four-wheeled tank which is arranged to throw the water from the back corners near the ground with either a heavy or light spray. It covers a space 24 feet wide, and can also be used for washing streets by using the heavy flow. The distance that can be watered by a van in any day will depend entirely upon the weather conditions, but each van can roughly distribute about ten loads per day.

Shingling of Roads.—The spreading of shingle (sand or fine gravel) on slippery and greasy roads is an important duty of the cleansing staff. This work is generally attended to by the street orderlies.

Granite pavements require shingling in almost all kinds of weather on steep gradients, but it is not necessary to shingle them on the level except in greasy or frosty weather. Smooth asphalt pavements will invariably require shingling in greasy or frosty weather. Wood pavements should not be shingled unless they have been watered (and, as the author has already explained, it is preferable not to water them), as the dust of the shingle will be blown about as soon as the pavement is dry. The shingle used should be fine grit which is capable of being passed through a screen not more than ⅜ inch mesh.

Refuse destructor clinker has been tried for the shingling of streets, but it has not been found satisfactory, as it disintegrates too easily, and then forms further dust.

Shingling should be carried out as sparingly as possible, since it must be recollected that the whole of the shingle put down will have to be taken up again after it has served its purpose.

Emptying of Surface Gulleys.—Street gulleys, if they are to serve their purpose, should be frequently emptied. In towns where asphalt and wood pavements are cleaned by means of hose pipes the gulleys should be emptied previous to the cleansing operations, in order that as much solid matter may be intercepted by them as possible. They should also be emptied immediately after the cleaning has been finished, in order that they may stand empty in the event of rain occurring. In many towns a gulley cleaner is attached to the night staff, whose sole work is to attend to them.

In Tottenham a number of storm overflows have recently been fixed in connection with the gulleys in positions where large volumes of water pour down the channels during heavy thunder-storms. These materially assist in getting rid of the water quickly, while they also provide an outlet for the water when the gulley gratings become choked. There is considerable liability of this occurring in the outlying residential districts, where, especially during the autumn months, the leaves of trees are likely to form an obstruction. The gulleys should be refilled with clean water to which a little disinfectant has been added after each time of emptying.

Removal of Snow.—In large towns this forms one of the most difficult branches of the work which the cleansing department is called upon to perform, since no estimate can be made of the amount which will have to be dealt with, and often the work of removal will have to be performed several times over in the course of a few hours. In some instances there may be special facilities for snow removal, as in the case of seaside towns and those situated on rivers, where the snow is generally disposed of by being tipped either into the sea or the river, as the case may be. Then again, in the case of seaside towns salt water is often available for swilling down the roads. This can only be done, of course, when there is no frost. The most important consideration when dealing with snow is that the system of removal should be so thoroughly organized that when the time comes to act each man may know exactly what is required of him. The question of snow removal has been so thoroughly dealt with in a paper read by Mr. Arthur May, cleansing superintendent of Finsbury, in 1907, before the Institute of Cleansing Superintendents, that one cannot do better than to briefly outline his system.

His plan has been to divide his district up into sections, with a working ganger in charge of each. Over several of these gangers there is a foreman, over several foremen an inspector, and the whole staff is under Mr. May's personal supervision. Each ganger has a printed card showing the streets he will work upon. A similar copy is given to the foremen and inspectors, while a copy is also retained in the office for making up wages, etc. On the back of each card are written the names of the men employed in the gang. A gang may consist of from twelve to twenty men, but in no case is a gang sent out without having a fair proportion of regular employes to work with it. Every gang thus sent out has on its list a portion of a main road whereon to start work, and consequently when the gangs are all out the main roads of the borough are being dealt with simultaneously. On each list likewise there is a section of the by-turnings so arranged that where the men finish on the main roads they will commence their work on these streets. An endeavor is always made to provide sufficient gangs, so that the roads may be well under control within twelve hours of a downfall. Every employe of the council is warned to report himself at the depots for work immediately a fall of snow occurs, and casual labor is employed in addition.

The first step, the moment it begins to snow, is to load the necessary number of vans with salt, a stock of which is always kept on hand. Three men are sent out with each van, and in less than two hours it is possible to have the whole of the district thoroughly salted down, footways and carriageways. The sooner this is distributed the better, as any fresh snow falling will break up as soon as it comes in contact with the salt. After allowing the salt a reasonable time to act, a personal inspection of the district is made to note its conditions. This is important so as to avoid sending out large bodies of men with tools, etc., that may be useless, and will require to be changed, which would mean a great loss of time at the beginning of operations.

The first duty of the sweepers is to get all the snow well into the roads,

clear all channels and gulleys, and then to churn over the mixture of salt and snow. As soon as the snow has been converted into slush by this process, the flushing gangs are dispatched with all available water vans and machine brooms, and the slush is swept or flushed into the sewers as soon as possible. The amount of salt generally required is about one ton for every three-quarters mile of street. It will be noticed that no carting is done under this system.

A very similar system of snow removal to that outlined above is adopted at Liverpool.

In Bolton the system of carting away the snow is adopted, as only clean snow can be put into the river. The difficulty of getting rid of the snow is increasing each year, as tips and vacant plots of land upon which it can be deposited are becoming more scarce, so that the bulk has, in many instances, to be carted long distances. At one of the depots a snow melter is in use which is able to melt fresh fallen snow at the rate of a load aminute.

A somewhat different method of dealing with snow has been prepared for the borough of Paddington by Mr. H. W. Sawyer, the cleansing superintendent. If a fall of snow should occur in the night, the depot watchmen proceed at 3 a. m. to call certain of the regular employes whose duty it is to call others, so that in a short time each regular employe will have been called and must report himself for duty by 4:15 a. m. at his particular depot. The employes are divided into 82 gangs, from two to three regular men being attached to each gang, and the rest made up of casual labor. The best of the regular men act as gangers, and they are made acquainted with their work beforehand, each being given a sheet of instructions and a list of the streets to be attended to by his gang. The streets are divided into three classes, viz., primary, secondary and tertiary, which are cleared in the order given, so that the whole of the staff are first set to work on the principal streets. Their duty is to clear the footways, crossings and channels, and to make gaps in the ridges of snow left at the roadsides by the passage of the snow plows. The gangs are grouped together with from seven to ten gangs in a group, each supervised by a special foreman.

The roads also receive attention from the horse staff. Five routes have been prepared of the streets in order of importance, as far as can be done consistently with efficiency, and each route is in the charge of a foreman whose duty it is to make and maintain a clear passage for two lines of traffic. To do this he has a snow plow, drawn by six horses, and several road-sweeping and scraping machines. Salt is not allowed to be used without special instructions. No more carting is done than is necessary to clear the main thoroughfares in front of shops, or where it is likely to be an annoyance; and in residential streets it is allowed to remain at the sides of the roads while in a tolerably clean condition. Thus, should a thaw set in a considerable expenditure in cartage and subsequent disposal is saved. The snow that is removed from the highways is shot into the sewers through manholes situated in various parts of the borough.

RELATIVE COST OF MUNICIPAL WORK DONE BY DAY LABOR AND BY CONTRACT.*

By Harrison P. Eddy, Consulting Engineer, Boston, Mass.

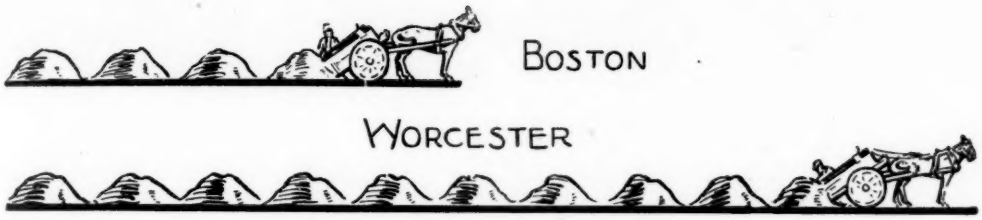
AMONG the various lines of investigation carried out by the late Boston Finance Commission were several which threw considerable light upon the relative efficiency of the contract and day-labor systems and some of the causes of the inefficiency of the day-labor forces of the city of Boston.

An effort was made to ascertain as nearly as possible the actual facts in all cases, and to reduce the conditions to figures, thus eliminating opinions.

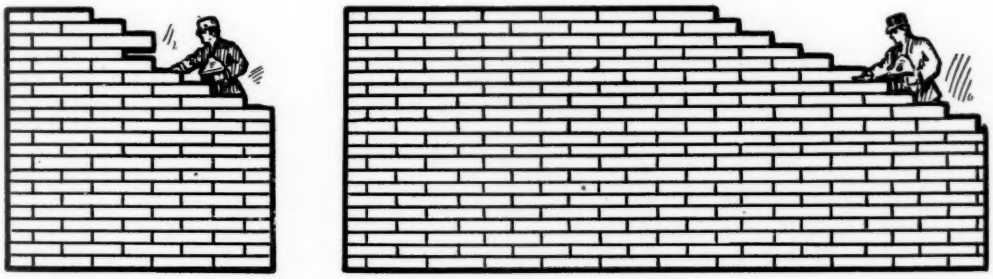
The results of these investigations are, therefore interesting and important, as showing the results of conditions surrounding city departments, and not as exploiting theories of ideal conditions which are rarely found in any city.

While most of the data refer to the

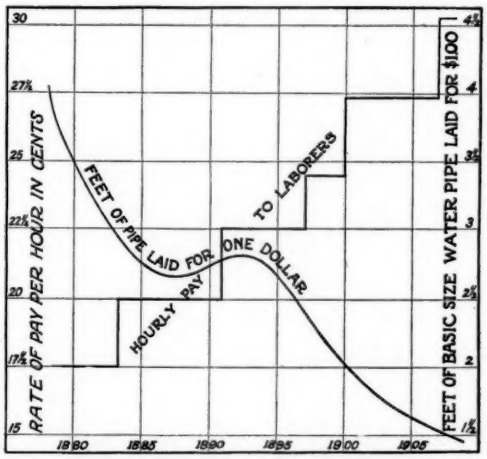
*From a paper before the American Association for the Advancement of Science.



A Day's Work in Teaming in Boston and in Worcester.



A Day's Work in Bricklaying—City Day Labor, 240 Bricks an Hour; Metropolitan Water-Board Contract, 570 Bricks an Hour.



Increase of Pay and Decrease of Efficiency of Labor in Laying Water Pipe in Boston.

city of Boston, it is believed that the lessons drawn from them are typical, and that similar results would be obtained from like investigations in many other cities.

In order to ascertain the general municipal practice throughout the country in building water works and sewerage systems, a postal card inquiry was sent to all cities in Massachusetts, and to all cities in the country exceeding 30,000 in population, as shown by the Census Bureau in 1905. The results of this inquiry appear in table 1. The questions were so worded as to apply only to ordinary extensions, and it is probable that in same cases work upon new systems may have been done by contract, while ordinary extensions were made by day-labor.

Postals were sent to 154 cities, and replies relating to sewerage systems were received from 73 cities, and relating to water works extensions from 58 cities.

Of the 73 cities making replies to the inquiries relating to sewerage systems, 52, or 71 per cent., were found to be doing this class of work wholly by contract. Of the cities located outside of New England, 94 per cent. were found to be doing their work by contract, while but 67 per cent. of the cities in New England outside of Massachusetts were using this system, and in Massachusetts only 6 per cent. The prevalence of the day-labor system in Massachusetts is very strikingly shown by these figures, which, it should be noted, are based upon replies from all of the 18 cities to which inquiries were sent. Putting it in another way, of the 18 cities in Massachusetts, 1 was doing its sewer work wholly by contract, while 17 were doing similar work wholly by day labor.

Replies to the inquiries relating to water works extensions were received from 58 cities, and if this number 33 per cent. were found to be doing the work wholly by contract. Outside of New England 48 per cent. of the cities have adopted the contract system, while in Massachusetts of the 15 cities making reply to the inquiries all were found to be doing the work by day labor. The results of the inquiries relating to water pipe extensions are very similar to those relating to sewer construction, and both show very clearly that the day-labor system is very widely adopted in Massachusetts, and much more prevalent in that State and in New England than throughout the remainder of the country.

A comparison was made of the cost of building sewers in cities where work was known to be done by day-labor with that in other cities where similar work is done by contract. These com-

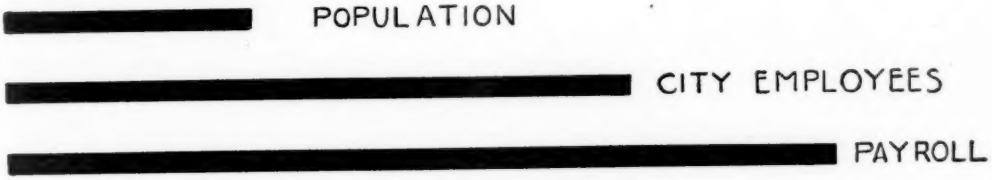
TABLE 1.

RELATIVE PREVALENCE OF CONTRACT AND DAY-LABOR IN AMERICAN CITIES OF POPULATIONS EXCEEDING 30,000 (not including Boston).

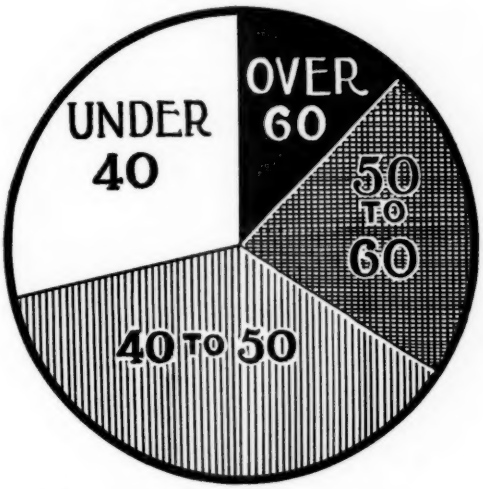
Population.	Number of Cities of Specified Size (1905 Census Estimate).	Number of Cities Enumerated.	Cities Doing Work Wholly by Contract.	Cities Doing Work Wholly by Day Labor.	Per Cent. of Cities Doing Work by Contract.
SEWER CONSTRUCTION.					
50,000-100,000	47	22	15	7	68
30,000- 50,000	67	31	20	11	65
100,000-150,000	14	8	5	3	63
150,000-200,000	6	2	2	—	100
Over 200,000	20	10	10	—	100
Totals	154	73	52	21	71
Outside of New England	126	51	48	3	94
New England, excepting Massachusetts	10	6	4	2	67
Massachusetts	18	18	1	17	6
WATER PIPE LAYING.					
30,000- 50,000	67	26	9	17	34.6
50,000-100,000	47	15	5	10	33.3
100,000-150,000	14	6	1	5	16.7
150,000-200,000	6	2	..	2	....
Over 200,000	20	9	4	5	44.4
Totals	154	58	19	39	33.0
Outside of New England	126	40	19	21	48.0
New England, excepting Massachusetts	10	3	..	3	....
Massachusetts	18	15	..	15	....

parisons were confined to New England cities, and very largely to cities in Massachusetts.

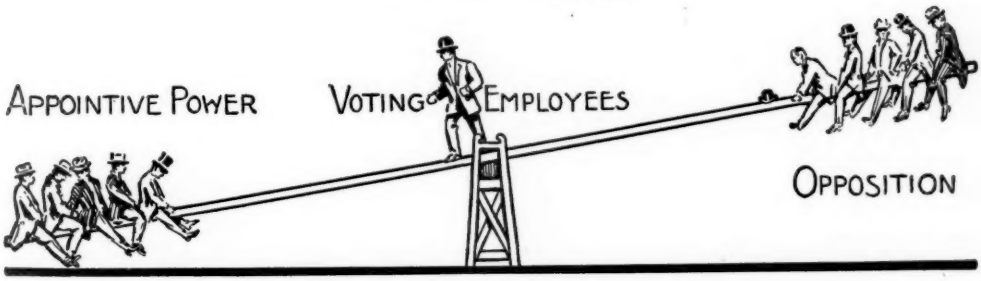
To make this investigation less difficult and reduce the element of uncertainty as much as possible, the inquiry was confined to small pipe sewers from 8 inches to 12 inches in diameter. Since most sewers of this class built in Boston have been constructed under contracts (largely "gift" or non-competitive contracts), the number available for comparison was smaller than was desired. As the difficulty in selecting work done under comparable conditions was fully realized, and as such selection could only be made by engineers familiar with local conditions, an assistant was sent from place to place to interview the local engineers, who always very kindly, and at times at considerable inconvenience to themselves, carefully considered the conditions surrounding a large number of pieces of work, and advised which should be selected for use in this comparison. The number of sewers selected in each city was small, but included



Relative Increases from 1895 to 1907.



High Percentage of Old Men Among Boston Sewer Laborers One Cause of Inefficiency.



The Votes of City Employes May Govern the Situation.

all which could be classed as being built under conditions enabling fair comparison within the last few years. While it is realized that this study may be criticised as being based upon fragmentary and possibly insufficient data, it is presented as comprising the best data which could be obtained after a long and earnest effort to get at the truth. Unfortunately, in no city except Boston was this class of work found to be done both by day-labor and by contract, so that comparisons between the two methods in the same city were impossible, with the single exception noted.

These investigations were made in 17 cities, 13 of which do their work by day-labor (including Boston, which does part of its work by day-labor and part by contract), and 5 (including Boston) which do the work by contract. The average cost of building 12-inch sewers in 12 cities was found to be $2.17 per linear foot, while in the city of Boston similar work appeared to cost $5.20 per linear foot. Like work done by contract was found to cost on the average $1.82 in 4 cities, while in Boston it cost $2.35. The average cost of labor and teaming in cities, exclusive of Boston, where the work was done by day-labor, was $1.34 per linear foot, while in the four cities doing work by contract this cost averaged $0.75 per linear foot. The cost in Boston by day-labor was $3.50 per linear foot, while upon work done by contract it was $1.05 per foot, a reduction of 70 per cent.

In tables 3 and 4 the cost of labor upon small sewers built by day-labor

TABLE 2.

AVERAGE TOTAL COST PER FOOT OF COMPARABLE 12-INCH SEWERS LAID 10 FEET DEEP, IN VARIOUS CITIES.

"A" BUILT BY DAY LABOR.

City or Town.	Prevailing Diameter of Sewer (Inches).	Actual Total Cost Per Foot.	Total Cost of Equivalent 12-inch Sewer Without Allowance for Difference in Wages.	Subdivision of Cost Into: Labor and Teaming Only.	Materials and Sundries.	Engineering.
(1)	(2)	(3)	(4)	(5)	(6)	(7)
Brockton	8-inch	$1.73	$1.96	$1.20	$0.68	$0.08
Cambridge	8-inch	2.35	2.58	1.70	0.81	0.07
Everett	8-inch	2.09	2.32	1.55	0.68	0.09
Fitchburg	12-inch	1.80	1.80*a*	0.95	0.77	0.08*a*
Haverhill	10-inch	1.68	1.80*a*	0.90	0.82	0.08*a*
Lawrence	10-inch	2.38	2.50*a*	1.80	0.62	0.08*a*
Lowell	10-inch	2.30	3.42	2.35	0.98	0.09
Medford	8-inch	1.80	2.03	1.05	0.92	0.06
New Bedford	10-inch	1.88	2.00	1.30	0.67	0.03
Newton	8-inch	1.65	1.88	1.05	0.73	0.10
Quincy	8-inch	1.54	1.77	1.00	0.68	0.09
Worcester	10-inch	2.00	2.00*b*	1.20	0.70	0.10
Average			$2.17	$1.34	$0.75	$0.08
Boston	12-inch	$5.20*d*	$5.20	$3.50*c*	$1.55	$0.15

*a*Engineering estimated $0.08 per ft.
*b*Exclusive of office and shop charges, as in other cities.
*c*Owing to the fact that this figure is based upon a comparatively small number of examples, it should be used with caution.
*d*Not including proportion of undivided construction cost, which amounts to about 5 per cent. of total construction cost.

"B" BUILT BY CONTRACT.

Brookline	8-inch	$1.73	$1.95	$0.80	$0.80	$0.25*
Portland	10-inch	1.50	1.62	0.65	0.81	0.16*
Providence	12-inch	1.68	1.68	0.65	0.83	0.20*
Somerville	8-inch	1.75	2.05	0.90	0.91	0.24*
Average			$1.82	$0.75	$0.86	$0.21
Boston	12-inch	$2.35	$2.35	$1.05**	$0.90	$0.40

*Engineering and inspection.
**Advertised contracts only.

NOTE: That no correction has been applied no account of difference in wages.
NOTE: That the day-labor cost shown in column 4 includes labor on manholes, whereas the contract labor does not include this, but does include loss on sheeting, which substantially offsets it.

TABLE 3.

COST OF LABOR, TEAMING AND ENGINEERING UPON SMALL SEWERS BUILT BY DAY LABOR.

LABOR COSTS REDUCED TO UNIFORM BASIS OF $0.315 PER HOUR, AS PAID IN BOSTON.
DATA REDUCED TO UNIFORM BASIS OF 12-INCH PIPE LAID 10 FEET DEEP.

City or Town.	Cost of Labor per Foot, Including Teaming, Excluding Office and Shop Charges.	Nominal Wage per Day of Eight Hours.	Actual Net Rate of Wage per Hour for Common Labor.	Cost per Foot of Labor Reduced to Comparable Basis (Rate = $0.315 per Hhour).	Cost of Teaming per Foot.	Cost of Engineering per Foot.
(1)	(2)	(3)	(4)	(5)	(6)	(7)
Brockton	$1.20	$2.25	$0.281	$1.34	$0.03*	$0.08
Cambridge	1.70	2.00	0.267	2.01	0.06	0.07
Everett	1.55	2.00	0.261	1.87	.....	0.09
Fitchburg	0.95	1.75	0.220	1.36	.....	.....
Haverhill	0.90	2.00	0.250	1.13	.....	.....
Lawrence	1.80	2.00	0.250	2.27	.....	.....
Lowell	2.35	2.00	0.250	2.96	.....	0.09
Medford	1.05	2.00	0.250	1.32	.....	0.06
New Bedford	1.30	2.00	0.250	1.64	0.04	0.03
Newton	1.05	1.75	0.219	1.51	0.06	0.10
Quincy	1.00	1.75	0.219	1.44	.....	0.09
Worcester	1.20	1.85	0.231	1.63	0.11	0.10
Average			$0.246	$1.79	$0.06	$0.08
Boston	$3.50**	$2.25	$0.315	$3.50**	$0.50	$0.15*a*

*a*Estimate.
*Contract teaming only; department has one horse and wagon.
**Net, including proportion of undivided construction expenses, which amount to about 5 per cent. of total construction cost. Furthermore, owing to the fact that this figure is based upon a comparatively small number of groups, it should be used with caution.

TABLE 4.

COST OF LABOR, TEAMING AND ENGINEERING UPON SMALL SEWERS BUILT BY CONTRACT.

LABOR COSTS REDUCED TO UNIFORM BASIS OF $0.315 PER HOUR, AS PAID IN BOSTON.
DATA REDUCED TO A UNIFORM BASIS OF 12-INCH PIPE LAID 10 FEET DEEP.

City or Town,	Cost per Foot for Labor and Teaming.*	Corresponding Rate Wages of per Hour.	Cost of Labor *a* Reduced to a Comparable Basis (Rate of Wage = $0.315 per Hour).	Cost of Engineering and Inspection.
(1)	(2)	(3)	(4)	(5)
Brookline	$0.80	$0.22	$1.15	$0.25
Portland	0.65	0.20	1.02	0.16
Providence	0.65	0.17	1.20	0.20
Somerville	0.90	0.22	1.29	0.24
Average	$0.75	$0.20	$1.17	$0.21
Boston**	$1.05	$0.25	$1.32	$0.40

*Exclusive of labor in manholes, but including loss on sheeting. It is estimated that these two items substantially balance each other, so that the figures are directly comparable with the day-labor figures of Table 3.
*a*It should be noted that contractors in Boston usually pay but $0.25 per hour for labor unless required to pay higher wages by the city.
**Advertised contracts only.

and by contract has been tabulated after being reduced to a uniform basis of wages of $0.315 per hour, the rate paid in Boston.

Reduced to this basis, it appears that the cost of sewers built by day-labor (not including Boston) averaged for labor $1.79 per linear foot, while in the cities doing work by contract (excluding Boston) the average cost of labor was $1.17. Treating in the same manner similar work done in Boston by day-labor and by contract, it is found that the labor cost was $3.50 and $1.32 per linear foot, respectively. It therefore appears that had the rate of wages been uniform in all cities the labor cost of the work done by contract would have been 35 per cent. less than the labor cost of that done by day-labor, not including Boston in this comparison. Comparing the work done by both methods in the city of Boston, it appears that had the work done by day-labor been done by advertised contract, the reduction in the cost of labor would have amounted to over 62 per cent.

An effort was made to ascertain the prevailing rate of wages paid by contractors in the vicinity of Boston for work similar to that performed by the city water and sewer departments. Data were obtained from 35 different contractors.

The minimum rate of wages paid in this vicinity appears to be $0.15 per hour, and the maximum did not exceed in any case $0.30 per hour. Comparatively few laborers are employed at rates of pay exceeding $0.25 per hour, while large numbers are paid as low as $0.20. In general, it may be stated that English-speaking laborers are paid more than others, and further, that the rate of $0.30 applies quite generally to building laborers or to laborers who possess rather more than average skill. In no case was it found that laborers were paid for legal holidays, and only in two instances were Saturday afternoons allowed. None of the contractors gave Saturday afternoons off with continued pay, and in no case were laborers paid in event of absence from work on account of injuries received.

The contractors furnishing data do not "carry" their employes through the winter unless they have work which must be done. In other words, they do not "find" work for their laborers during the winter season as do the city departments, and consequently they do not give continuous employment.

Inquiries were sent to sewer departments of all the cities in Massachusetts, and several of the larger cities of the other New England States, to ascertain the length of day and the rate of wages in force upon municipal sewer work in the city departments. The data thus collected are compiled in table 5. Several of the cities included in this inquiry performed their construction work by contract, so that the figures given in those cases apply only to the maintenance forces. From these data it appears that the prevailing length of day is 8 hours, although in some cases a 9-hour day is required. Excluding Boston, the nominal rate of pay varies from $0.17 to $0.287 per hour, while the prevailing rate of pay may fairly be said to not exceed $0.25 per hour. In about one-third of the cities the laborers are permitted to have half holidays on Saturday, although in about one-half of these cases the half holidays are restricted to the summer months. In several of the cities where half holidays are granted the length of day is so arranged that the laborers work 48 hours during the week. In 5 cities granting Saturday half holidays laborers are paid in full for Saturdays during the summer months (varying from two to six months).

From a comparison of the wages paid by contractors and by municipalities, it is evident that city laborers are paid considerably more than laborers employed by contractors and that they work fewer hours per week. It is difficult to determine the relation existing between high wages and the efficiency of the employes. It is doubtless true, however, that higher wages are paid by municipalities very largely because of political influence.

In this connection it is very interesting to note the increase in wages paid for common labor in the city of Boston from 1878 to 1907. From 1878 to 1883 the wages paid were $1.75, and the length of the day was 10 hours. In 1883 the rate of wages was increased to $2 per day. In 1891 the length of day was reduced to 9 hours, and in 1897 Saturday half holidays were allowed with pay. In 1900 the 8-hour day was granted, together with the continuance of the Saturday half holiday, and in 1907 with the same hours the rate of wages was increased to $2.25. It therefore appears that between 1878 and 1907 the rate of wages had increased from $1.75 to $2.25 per day, or 28 per cent., and the hours of work had been reduced 26 2-3 per cent. The result of reducing the length of day and

TABLE 5.

STATISTICS CONCERNING THE DAY-LABOR FORCES OF THE SEWER DEPARTMENTS OF VARIOUS CITIES.

City.	Number of Laborers.	Length of Day.	Rate of Pay Nominal (per Hour) Cents.	Rate of Pay Actual (per Hour) Cents.	Saturday Half-Holidays Allowed.	Pay for Saturday Half-Holidays.	Allowance for Sick Leave.
Lynn, Mass.....	101	8	28 1/8	28.7	May-Oct.	Yes	None*a*
Haverhill, Mass....	...	9	28 1/8	28.7	June-Sept.	Yes	None*c*
Fall River, Mass...	178	8½	28 1/8	28 1/8	Yes	..**	None
Brockton, Mass.....	178	8½	28 1/8	28 1/8	No	..	None*d*
*New Haven, Conn..	...	9	27 7/9	27 7/9	No	..	None
Cambridge, Mass....	21	8	25	26.1	May-Nov.	Yes	None*a*
Springfield, Mass...78—153		8	25	25 1/2	Work 7 hrs.	Yes	None*c*
Chicopee, Mass.....	...	8	25	25	No	..	None*a*
Holyoke, Mass.....	...	8	25	25	Yes	..	*a*
Lawrence, Mass....	114	8	25	25	Yes	..**	Half pay
Lowell, Mass.....	...	8	25	25	In summer	..**	None
Marlboro, Mass.....	...	8	25	25	No	..	None
Medford, Mass.....	...	8	25	25	No	..	None
New Bedford, Mass.	86	8½	25	25	Yes	..**	None
Newport, R. I.....	...	8	25	25	No	..	None*a*
Waltham, Mass....	...	8	25	25	No	..	None
Newburyport, Mass.	5	8	25	25	No	..	None*c*
Quincy, Mass.....	...	8	23 1/8	23 1/8	No	..	None*d*
Worcester, Mass...	168	8	23 1/8	23 1/8	No	..	None
*Hartford, Conn.....	...	9	22 2/9	22 2/9	No	..	None
Waterbury, Conn...	14	9	22 2/9	22 2/9	No	..	None*c*
Bangor, Me.....	4	9	22 2/9	22 2/9	No	..	None
Fitchburg, Mass....	...	8	22	22	No	..	Full pay*b*
*Albany, N. Y.....	...	8	21 8/9	21 8/9	No	..	None
North Adams, Mass.	28	8	21 8/9	21 8/9	No	..	None*c*
Newton, Mass.....	75	8	21 8/9	21 8/9	No	..	None
Concord, N. H.....	...	9	19 4/9	19 4/9	No	..	None*a*
*Portland, Me.....	...	9	19 4/9	19 4/9	No	..	None*d*
Hudson, N. Y.....	...	8	18 3/4	18 3/4	No	..	Full pay
*Providence, R. I...	84	9	17	17.2	July-Aug.	Yes	None*c*
New London, Conn.	40	9	18 2/3	16 2/3	No	..	None*c*
*Somerville, Mass...	8—15	8	..	..	In summer	..	None
Boston, Mass.....	2,000	8	30 3/4	31 1/2	Yes	Yes	Full pay*c*

*Maintenance only; construction by contract.
*a*In case of injury, submitted to a committee.
*b*Full pay may be allowed not to exceed 60 days, when approved by mayor.
*c*Full pay if injured on work.
*d*Unless injured on work.
**Work 48 hours per week, but time divided so that Saturday is a half-holiday.

increasing the rate of pay is made more apparent by comparing the rate of compensation per hour as in table 6.

TABLE 6.

WAGES OF LABORERS EMPLOYED BY CITY OF BOSTON.

NOMINAL TIME WORKED AND WAGES PAID.

Period.	Hours per Week.	Nominal Rate of Wages. Per Day.	Per Hour.
1878-1883 ...	60	$1.75	17½c
1883-1891 ...	60	2.00	20c
1891-1897 ...	54	2.00	22½c
1897-1900 ...	50	2.00	24c
1900-1907 ...	44	2.00	27½c
1907-date ...	44	2.25	*31½c

*Allowance made for legal holidays for which full pay is allowed.

From this tabulation it appears that the hourly wage, making due allowance for the Saturday afternoons and holidays, has increased from $0.175 to $0.315, an increase of 80 per cent. in the cost to the city for the work done, assuming equal efficiency. In this connection is should be noted that while the cost of labor to the city has increased 80 per cent. per hour, the increase in daily wages received by employes has amounted to but 28 per cent.

It is further important to note that while the cost per hour to the city for labor has increased 80 per cent., the efficiency of labor, as already shown, has fallen 50 per cent. In other words, a dollar's worth of time in 1878 would to-day cost the city $1.80, but the efficiency having dropped 50 per cent., the city is obliged to pay $3.60 for the amount of work done in 1878 for $1, an increase of 360 per cent.

It would not seem unreasonable to expect that some relation may exist between the rate of wages paid and the efficiency of labor—or, in other words, that enough work would be done per hour under the higher wages and

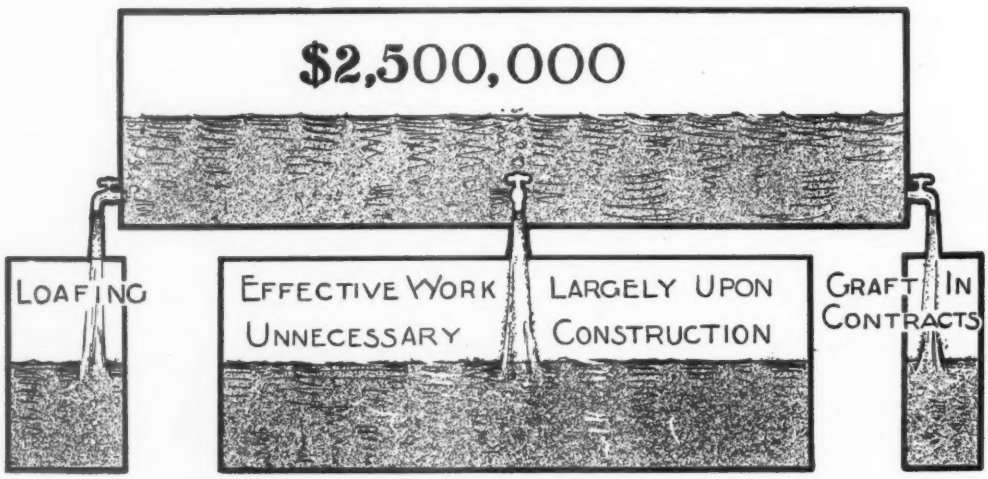
shorter hours, so that at least as many feet of sewer would be laid for $1 as in cases where lower rates of wages prevailed. The following tabulation made up from table 3 shows the number of feet of sewer laid for $1 when the wages are reduced to a uniform basis of calculation. The percentage of efficiency is calculated on the assumption that the Brockton labor was 100 per cent. efficient.

	Rate of Wages Actually Paid.		Number of Feet of Sewer Laid for $1, Figured on Uniform Basis.	Per Cent. Efficiency, Assuming 100% Efficiency in the One Case when Wages Equals $0.321.
	Per Day.	Per Hour.		
Brockton	$2.25	$0.281	0.746	100.0
Seven Cities.....	2.00	0.254	0.529	70.9
Worcester	1.85	0.231	0.613	82.1
Three Cities.....	1.75	0.219	0.694	93.0
Boston	2.25	0.315	0.286	38.3

While it may not be fair to draw the conclusion from these figures that labor is less efficient because of higher wages, it does seem to follow that higher compensation does not assure greater efficiency. The greatest efficiency was apparently obtained in the case of the city of Brockton, where the nominal wage is $2.25 per day, although in Boston, where the same nominal wage is paid and holidays granted in sufficient number to increase the rate per hour over 12 per cent., the lowest efficiency was indicated. Averaging the results obtained in cities paying the same rate of wages, there appears to be a gradual decrease in efficiency as the rate of pay increases.

While the difficulties of such investigations are many, it is believed that the results recorded represent very conservatively the conditions existing. It is apparent that municipal work done by day labor is in general, under the conditions of to-day, much more expensive than similar work done under the same conditions by contract. It is also apparent that the labor force in city departments where work is done by the day-labor system is very inefficient as compared with similar forces employed by contractors, and has, during the last ten or fifteen years, decreased greatly in efficiency, at least in the city of Boston.

There are many causes of the excessive cost of day-labor work and of the inefficiency of the day-labor forces, all of which may be grouped under the one great evil—the entrance of politics into municipal business. These causes include abnormal rates of pay, the granting of holidays and half holidays, the employment of aged and physically incompetent laborers, absence of discipline, a lack of incentive, and the inexperience of those in executive positions. It would further appear that the number of men growing old in the



Distribution of Appropriations in Boston Water and Sewer Departments.

service of the city, who were at the time of their original employment young and vigorous, is not a material cause of inefficiency. On the other hand, the employment of men in city departments who have passed their years of usefulness in the service of other parties has a demoralizing effect upon the labor forces, and has undoubtedly been the cause of much of the inefficiency noted in municipal day-labor forces.

BITUMINOUS HIGHWAY CONSTRUCTION.*

By Clarence A. Kenyon, Indianapolis, Ind.

IT is now settled beyond question that gravel and macadam roadways, no matter how well constructed, are not adequate to sustain anything but light automobile traffic (the Massachusetts Highway Commission says 100 vehicles per day), and all sorts of efforts have been made and are every day being made to overcome the known defects of the macadam roadway when subjected to modern methods of travel.

In the efforts which have been made to do so, many kinds of oils, plain and emulsified, various tar compounds and asphalts, liquid and otherwise, chemical compounds many and various, some merely poured, sprinkled or sprayed on the roadway; some mixed with cold stone, sand or gravel; some poured or mixed while hot, and some with the road metal and the bituminous material both hot and thoroughly mixed and compacted. Some of these materials and processes have met with more or less success, as they have approximated or departed from correct principles of road construction.

Europe is forging ahead. (In one section contracts for 70 miles of bituminous roadways were let last season.) Rhode Island and New Jersey have definitely decided not to construct any more merely macadam or gravel highways.

To be sure, the knowledge is common that the standard modern city pavements would be entirely adequate to meet the conditions, but the cost of construction of these pavements has in most instances practically prohibited their use for country highways. Even in the face of the cost there has been much urgent demand for paved highways. Brick, bitulithic and asphalt have, in some instances, been laid.

Let us review in a general way what has been done by experimenters in various ways.

1. Dust Layers.

Under this head may be included various chemical compounds, patented and otherwise, such as carbide, salts of various kinds, crude oils, heavy and light; so-called asphalt oils, emulsions, light tars, tar oils, light and heavy, and creosote oil. The methods of use of these various products differ, but as a rule they are sprinkled or sprayed (some cold, some hot) on the surface of existing roads, for the purpose of laying the dust, or rather preventing its rising.

The results may be generally summarized as follows: The oils mingle with the particles of dust and prevent their flying in the air, by a whirl of air or wheels. The tars spread a thin film over the surface where it is hard, and prevent the dust from flying; and the carbides and other solutions make wet the dust, and so keep it down; but in each and all of these experiments the result is only for a few months at most, except under extraordinary conditions. The treatment has to be renewed frequently, and is never permanent. In France the engineers, and shortly after the public, generally pronounced these results ineffective, except at considerable cost, and declared that the experiments demonstrated that no noticeable strength was added to the macadam or gravel surface.

In England the "Ballymeagh Trophy," value $500, was offered as a prize. Nineteen compounds competed. Each was laid for an equal distance, contiguously, on one of the main roads in Middlesex, and examinations were made semi-monthly by a committee of expert road engineers. R. S. Clare & Co., of Liverpool, were awarded the trophy on a tar compound, laid hot by spraying, but even that wore off in a few months and had to be renewed.

*A Paper before the Indiana Engineering Society.

None of these oils, light or heavy, or light tars were regarded as of any permanent value as a "binder" or cementing material for road construction.

In this country, in some localities, somewhat better results have obtained, especially where the heavy oils with asphaltic bases have been used, and the road itself was well constructed and the traffic light. In some cases where the roads were frequently oiled the light constituents gradually evaporated, and the heavy oil united with the sand and stone dust of the road and "caked" on the surfaces and gave the impression of a paved roadway. Capitol avenue in Indianapolis is a fair example of this. I believe the top surface was originally mixed with an emulsified asphaltic oil in a mixer and laid and rolled. The street has been oiled with the best grade of heavy oil two or three times each year for several years. The street is a boulevard, and all heavy traffic is prohibited. It has to be repaired every year.

The city engineer of Los Angeles, Cal., declared in a public report that after several years' experience they had found that as a pavement-maker the asphaltic oils even were a failure, and did not justify the hope that was formerly entertained for them.

It is to be regretted that some of the sellers of road oils have confused many people by claiming that some of these heavy oils were asphalt binders, cements, etc., instead of dust layers.

The cost of applying these various "dust layers" has been tempting—from 2 cents to 10 cents per square yard for each treatment. The price has been sufficiently attractive to tempt many well-meaning people to more than half believe the lurid statements and "fine" photographs of the promoters.

2. Binders.

By this is meant some form of bituminous material that will bind or cement the particles of road metal (sand, gravel or stone) together. These cements are usually made from (1) natural asphalt, fluxed to a standard degree of consistency, (2) pitch, made from coal gas tar, to a standard degree of consistency.

Efforts are constantly being made to mix a small percentage of asphalt with a large percentage of heavy petroleum oil, or oxidized oil (and it can be oxidized so as to be as hard as asphalt or pitch), and call the resultant product "bituminous cement" or "binder" for road materials. Some agents even go so far as to claim that the material is 88 per cent. asphalt, etc., and the question is often asked, how is the engineer or public official to prove to the contrary? Eighty-eight per cent. will dissolved in carbon disulphide, and the chemists do not deny it, etc.

The writer believes that it is at present an accepted fact that chemical analysis is barren in its efforts to tell the physical qualities of these bituminous substances. Most of them are hydro-carbons, and the chemical analyses of certain gases and of pure asphalt are the same. These substances, at least many of them, are what are known as isomers, as many as 98 substances with different physical qualities, and yet in the chemist's laboratory they are all hydro-carbons with the same formula, $C_9H_{10}O_3$. It must be clear, then, that for the engineer to be reasonably sure of his ground he must (1) prescribe and use only such materials as extensive experience has proven to produce bituminous cements of effective value (even then great care must be used in the handling by expert workmen and directors), or (2) he must have a series of accurate tests to determine the physical qualities of a bituminous cement of a certain consistency, just as we have standard tests for determining the physical qualities of Portland cement, Rosendale, Louisville and other hydraulic cements.

A large number of experts are at work now trying to devise and formulate such a series of tests. Progress is being made, and I predict that in a few years tests will be standardized for bituminous cements the same as they are now for hydraulic cements. In spite of all this uncertainty, much is accurately known from experience, and the demand for bituminous pavements goes unceasingly on. A few axiomatic facts are elemental and helpful.

If a bituminous material will cling to stone, gravel or sand at the ordinary temperature of summer air, say 78 degrees F., and at the same time catch and hold small grains of mineral and dust, but will not hold by the cementing strength of the bituminous cement another stone or stones, say of ordinary road metal, from falling from it when suspended, it is safe to say it is a dust layer, if anything, and not a cement or asphaltic "binder," or in fact any kind of a "binder."

Don't mistake me. If you lay down 2-inch macadam stones and press mud between the stones, the mud seems to act as a binder, but the mud has practically no cementing quality. The mo-

ment the edge of the pavement is raveled the stones fall apart. Oil may be oxidized so hard that the result is analogous, but the cementing quality is so slight as to be of no permanent value.

Heavy petroleum oil is not a cement, and will not become a cement by pouring it on a road and waiting for the light oil to evaporate. The light oils have already been taken from it by from 500 to 600 degrees F. of heat. Nor do I believe that mixing 10 or 20 per cent. of natural asphalt with 80 to 90 per cent. of heavy oil will produce bituminous cement. A material that can be mixed cold is not likely to be cementitious.

Mixing hot bituminous cement with cold, damp stones does not produce a good result.

A bituminous material to be a binder or cement must at ordinary air temperatures actually stick to the stones with great tenacity and bind or fasten them together. The greater its tensile and compressive strength is, the better; besides, the material should not lose its strength or become brittle in cold weather, nor lose its strength and become too soft under summer heat.

The simplest and best test of road materials is their behavior under actual usage for a term of years. All of the empirical or hurry-up tests may lead you into error. The safest rule for the present seems to be to prescribe only the best of the well-known and standard cements made of asphalt or coal gas tar, carefully refined.

The next question, after having decided on a suitable bituminous cement, is the character of the construction to be adopted. While there are many forms and classes of construction that the limits of this paper prevent discussing here, they may be roughly divided into two classes:

1. The Penetration Method.
2. The Mixing Method.

In either class of construction it is assumed that the road has been suitably graded and drained, and the subfoundation properly compacted.

Upon the sub-foundation is spread the coarse stone or road metal, and rolled to the proper contour. This may be poured with heated bituminous cement, or it may be treated as a foundation. If the latter, a surfacing of from 2 to 3 inches of smaller stone, say from 1 to 2 inches in largest diameter, the smaller stones evenly distributed through the larger stones, carefully and evenly spread over the foundation and poured to the extent of about 1½ gallons of the heated bituminous cement per square yard of surface, care being taken not to form pools or fatty places. This should be carefully and thoroughly rolled and top-dressed with screenings and rolled again. If this coating of fine stone, gravel and sand be again poured, or, what is better, sprayed, while adding some to the cost, it more than makes up in value. Pouring should not be permitted while the stone is wet, or the cement not properly heated. If 50 per cent. by measure of fine hot sand is incorporated in the hot cement, just before pouring, strength is added. An even grading of the stone, a low per cent. of moisture in it, a very uniform cement, used good and hot, uniform and plenty of rolling, all add to the construction.

The Indianapolis motor speedway was paved similarly. It was not successful, and has been abandoned, and yet there were large areas of that pavement that withstood the terrific strain of those heavy automobiles going at the rate of 100 miles an hour perfectly, and would have continued to do so for an indefinite time. In the writer's opinion the faults were: (1) In many places the sub-foundation was not properly drained, and the soft places gave way. (2) The road metal foundation was not heavy enough. (3) The grading of the stone in the surface was not uniform and did not permit an even penetration of the cementing material when it was poured into the surface. (4) The cement was not uniform in consistency; some was hard, some soft, and was not uniformly heated when used. (5) Some of the work was done in inclement weather when the materials were not suitable for this form of construction.

In spite of this, some very excellent results have been obtained in the East with this form of construction, and inasmuch as the cost is quite low, it is tempting. It excludes the water, prevents dust, except from dirt carried on it, and where the traffic is moderate requires few repairs.

It is believed that if a carefully compounded fine mixture, say from ¼-inch to mineral passing a No. 100 screen, be heated and thoroughly mixed with a standard paving cement, and this mixture be spread while hot, evenly over the paved foundation, say one-half to one inch thick, and driven into it by rolling, a very excellent result would be obtained, good enough even for city streets with light traffic.

The mixing method is to heat the road metal and while it is hot thor-

oughly mix it with bituminous cement, lay it on the foundation and compress it. Various ways and means may be adopted. A few general suggestions may help.

Care should be taken to have a firm foundation. Clean, hard stone of uniform grading of sizes; stones all of one-inch would be a failure, as would stones all of three-quarters or one-half inch or smaller. The fewer voids between the stones, the greater density of the mass (obtained by grading the sizes properly) and the smaller amount of cement required. Even spreading, uniform compression, careful construction, critical inspection, make for more in bituminous construction than in any other.

The cement sticks tighter and longer to a dry, hot stone (in fact, it slightly penetrates it) than to a cold, damp one. Uniform cement, uniform heat and uniform grading of the mineral aggregate insure the same thickness of the cement over the stone or sand surface, whether the particles be large or small, and uniform penetration is secured, all of which make for more durable and stable construction.

There is no reason why on even heavily traveled roads such construction should not endure for years, and the cost of maintenance be reduced to a minimum.

The cost per ton per mile of hauling produce over roads such as I have been describing is from 3 to 5 cents, while the cost per ton per mile on ordinary country roads is from 25 to 40 cents, according to condition and season. The saving on the hauling of five tons of wheat for each mile would pay, under ordinary conditions, for the construction of a square yard of the best of the roadways described. This saving would soon pay for the road, not to speak of saving in repairs.

Remember that the cost per unit per annum is the final test of the value of any paving material.

It is throwing money away to build macadam or gravel roads under present and threatening traffic conditions, and in this dilemma all eyes are being turned to some form of bituminous construction. It seems to be the one material with which a durable roadway pavement can be constructed at reasonable cost.

CROWNS OF PAVEMENTS.*

By Geo. C. Warren, President of Warren Brothers Company, Boston, Mass.

THE writer had read with much interest an article recently read before the American Society of Civil Engineers touching on the above subject, and perhaps some thoughts which come to his mind may be of interest.

At the outset he begs to plead for a less frequent use of algebraic formulae to express simple engineering propositions which could be more clearly stated in plain English. From the excellent paper above referred to the following algebraic rule for computing street pavement surface curvatures is quoted:

"The formula is $Y = \frac{bx^2}{a^2}$, in which b is the depth of the gutter below the grade of the center of the roadway, a is the half roadway, x is the horizontal distance from the center of the roadway, and v is the vertical distance below the grade."

I believe that most of those of us who have sufficient technical education to be able from this formula to calculate the desired curvature of surface for any particular street will agree that a simple statement in plain English would be better understood by the average man if not by the technical engineer.

Given a roadway having a width of 60 feet between curbs and a height of crown above gutter of 15 inches, the formula above quoted makes the grade at the quarter (point midway between crown and gutter) 3.75 inches below the crown and 11.25 inches above the gutter. How much more simple is the following plain English rule:

The result of this rule would be: Width 60 feet between curbs, divided by 4 = 15-inch crown; 15-inch crown divided by 4 = 3.75-inch level of quarter below crown, being exactly the same as the rather complicated algebraic formula quoted above.

As stated below, the writer is of the

*From a paper before the American Society of Municipal Improvements.

opinion that a better division of the fall is one-third from crown to quarter and two-thirds from quarter to curb, which, in the case of the above 15-inch crown, would provide a fall from crown to quarter of 5 inches and from quarter to curb of 10 inches.

The following formula is quoted as employed by the late Andrew Rosewater, C. E., in his practice as engineer of the city of Omaha:

"$H = \frac{W\ (100—4P)}{5{,}000}$, in which W is the width of the roadway and P is the percentage of grade."

How much more simple is the reported formula of the engineer of the Chicago West Park Commission:

"Make the crown two (2) per cent. of the width of the roadway." (Of course, meaning width between curbs.)

Mr. Rosewater's formula quoted above is the first time the writer has seen any published rule which recognizes the common-sense principle that the greater the percentage of grade the less should be the crown. In fact, the writer's observation is that municipal engineers very seldom modify their crowns to meet the varying conditions of either steep grades, streets having car track, or different pavement surfaces. With no allowance for car tracks the prevailing custom provides a fall between track and curb—perhaps only half the width between curbs—is the same as that planned for the same width of street without tracks. The result is that, as a general rule, the crowns on steep grades and on streets having car tracks are far too great for safety of horses or automobiles.

But is Mr. Rosewater's formula correct in the ratio of allowance for steep grades? With a roadway 40 feet between curbs and 2 per cent. grade, it would figure:

$$\frac{(100—4P) \text{ or } 92x40}{5{,}000} = .732 \text{ ft.} = 9.18 \text{ in. crown,}$$

which, in the writer's judgment, with classes of pavement providing the best foothold, is about correct.

With the same width and 6 per cent. grade, Mr. Rosewater's formula figures:

$$\frac{(400—4P) \text{ or } 92x40}{5{,}000} = .608 \text{ ft.} = 7.3 \text{ in. crown,}$$

which, in the writer's judgment, should not exceed 4 inches with any kind of pavement on a roadway having 6 per cent. grade, 40 feet width between curbs, and no railroad tracks.

Another important point. The writer has never seen in any published formulae, and far too seldom in practice, any recognition of the common-sense principle that some forms of pavement having smooth surfaces can stand and should have less crown that other forms of pavement providing better foothold.

(Rosewater gave one formula for asphalt and similar pavements and another for brick and other pavements of like surface. See MUNICIPAL ENGINEERING, vol. xiv, p. 247.—EDITOR.)

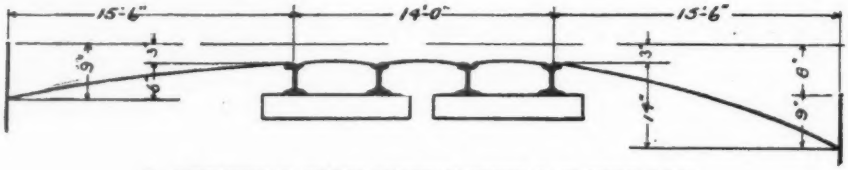
Engineers, too, are frequently, if not almost as a general rule, prone to provide that the crown shall be the same level as the top of the curb, regardless of the width of roadway or depth of gutter (exposed face of curb) required to properly carry the water to the catchbasins, with the result that many wide streets have too little crown or too great exposed face of curb (if not both errors) for either appearance or utility. The writer believes that the general tendency of engineers is to provide too flat crowns. Water is the great enemy of all forms of pavement, and unless the crown is sufficient to readily carry the water from slight depressions, which are necessarily to some extent in the surface of every pavement, the durability of that pavement is very greatly reduced.

There is no feature in pavement or roadway construction which should have more intelligent consideration of the engineer, and conversely, in the writer's experience, no feature which is given as little consideration to meet the conditions of each particular case as this matter of crown.

The following is a typical case of common error which has come to the writer's attention.

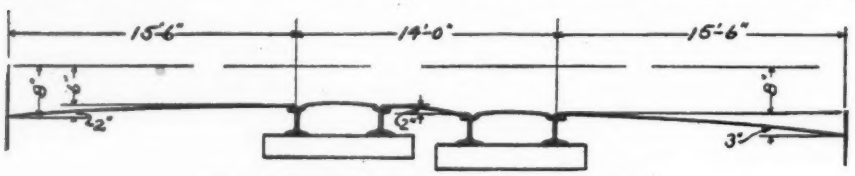
The width between curbs is about 45 feet with double track. A portion is nearly flat, and about 700 feet of the street has a continuous 8 per cent. grade. On the steep portion the top of the curb on the low side is about 8 inches higher than on the high side. With only one cross street, about the middle of the steep portion, the engineer provided 9 inches exposed face of curb to carry the water. On the flat portion he provided a desirable crown of say 6 inches, but carried the same crown up the 8 per cent. grade. The figures are from memory, but approximately correct, and illustrate the point. On the 8 per cent. grade, there-

fore, the cross-section is amout as in the first of the accompanying cuts (providing 14-inch crown on the low side in 14½ feet width between track and curb):



I. THE USUAL CROSS SECTION WITH ONE CURB LOW.

With the sidewalk and curb grades previously established, this condition provided an unusually difficult problem, especially at the intersections on the steep grade, but by providing additional catchbasins at intervals in the long steep grade, and 4-inch face of curb on the low side, and the track on the low side 2 inches below the high grade, it could have been very much improved as shown in the second cut.



II. PROPOSED IMPROVED CROSS SECTION.

This would provide 2-inch crown on the high side and 3 inches on the low side. By raising the curb and walks 1 inch to 3 inches on low side the depth of suggested gutter could be increased to from 4 inches to 6 inches.

Objection may be raised to establishing track grade on one side 2 inches lower than the track grade on the other side. The writer, however, can see no practical objection and great advantage in safety to horses and automobiles by this provision where the curb grade on one side of the street is necessarily lower than the curb on the other side. He believes that such objections as may be made are based on the novelty of such a provision, and that on calm consideration it will be seen to provide both better appearance and superior utility to the undesirably high and unsafe crown which is otherwise necessary.

At the cross street, about the middle of the 700 feet of 8 per cent. grade, the crown of the cross street was carried out to the track in the center of the street represented by the above cross-sections, with the result that from the point midway between the curb and track on the low side and the pavement surface at the low corner curb is a drop of about 24 inches in 20 feet, just at the point where horses must travel and change their footing while turning the corner from a flat to a steep grade, while the hoofs on one side are about three inches below the hoofs on the other side—a veritable horse trap—and the "pavement," not the "grade," is publicly denounced as unsafe and slippery.

The writer has adopted and recommended with good satisfaction the following general rule:

For pavements having smooth surface, such as asphalt, creosoted blocks, and grouted stone blocks and brick, and having grade of 2 per cent. or less, with no car tracks, make the crown one (1) inch to each six (6) feet width between curbs.

For pavements providing more secure foothold, such as stone blocks and bricks having bitumen filled joints, macadam or bitulithic, on streets having a two (2) per cent. or less grade, make the crown one (1) inch to each four (4) feet of wdith.

If street has car tracks, deduct the total width outside to outside of rails from the width between curbs and divide the difference (double width between track and curb) by six and four respectively.

For grades between 2 per cent. and 4 per cent. provide one-half the crown provided by the above computation.

For grades above 4 per cent. provide a crown one-third that of the above computation.

Provide one-third of the lateral fall between the crown and the quarter and two-thirds between the quarter and the curb. By "quarter" is meant the point midway between the center

of the roadway and the curb, or in the case of car-track streets, the point midway between the outside rail and the curb.

Some engineers have objected to such flat crowns on steep grades because they do not rapidly carry water to the gutter. The answer is, you cannot, in any event, on steep grades carry the water directly to the gutter, and it is better to let it run a little down the center of the street during the comparatively short periods of rainfall than to have the crown unsafe for horses at all times.

PAVEMENT MAINTENANCE ALONG STREET RAILROAD TRACKS.*

By F. V. P. Ellsworth, City Engineer, Hot Springs, Ark.

IN the smaller cities the street railroad companies are not justified in making a strictly first-class construction; that is to say, the using of 110-pound steel rail and the construction that is necessary in keeping therewith. For instance, in the city in which I live, the city of Hot Springs, Ark., we have but twelve miles of double-track street railway, and the amount of traffic over this street railway is not great enough to warrant such a heavy construction; nevertheless, those street railway tracks must be paved wherever the streets are paved.

The question arises, "What kind of construction is the most practicable?"

There is no doubt but that the T rail is the rail to use, and it should be of such weight as is best suited to the conditions.

Now, then, no matter how heavy the rail, nor how many ties or tie-rods used, nor how heavy the concrete work, nor how heavy the entire construction, there is bound to be some vibration along the rails. And in the small city with the lighter rail, using a wood tie and no tie-rods, the vibration is consequently greater and very noticeable.

Wherever there is vibration there is the resultant repair needed from time to time, and the greater the vibration the more often the repair. If the track needs repair, then the paving along said track must need repairs. Consequently, a sheet pavement is not practicable along the street railway tracks. Some kind of a block pavement must be used.

The question then arises, "What shall we do where the street on either side of the tracks is paved with a sheet pavement having a soft surface, such as asphalt, bitulithic, or other bituminous material?"

The common usage is to pave along the outside of the rails with the block used, and then pave up to it with the soft surface.

This is the easiest and cheapest method, but what about the future? What happens when those blocks are taken up in order to make track repairs? We know that the soft pavement will lose whatever bond it has on those blocks; it will also be broken in many places, especially when repairs are made in cold weather and the surface is more or less brittle. Consequently there is a rutty pavement along the street railway tracks. Who is responsible? The street railway company claim they must take up the blocks in order to make repairs, and had the street not been paved so close with the soft pavement they would not have broken it. They are not equipped to take care of the soft pavement, and should not be expected to stand the extra expense, when they are only required to go a certain distance from the rails.

The street is the sufferer, and remains in a rutty condition until it is so badly worn that the city must make large patches all along the street railway tracks and at a considerable expense.

Again, after the soft pavement has left the block there is nothing to support the block from that side or end, whichever the case may be. The bond is broken, and the block begins to tilt and rock and finally be crushed or rolled out of its bed. This calls forth still more objection by the traveling public until the proper repairs are made by both the street car company and the city at the same time.

*From a paper before the American Society of Municipal Improvements.

Something must be done, and this is a very good opening for the engineer to experiment.

I have a plan of construction which I have used, and I understand the city of New Orleans, La., has also used it with more or less success. It is the placing of a "liner" of granite, or other stone standing a strong abrasion test, along the outer edge or boundary line of the street railway company's right of way.

This liner should be dressed on top and ends and have a thickness not greater than 4 inches, and be not less than 3 feet in length, and of such depth as best suited to conditions, usually 12 to 18 inches. It should also and by all means be set on a concrete base or foundation.

At one letting of contracts for the paving of several districts under my charge I drew up specifications for a concrete liner, this liner to be entirely of concrete with the top or wearing surface to be composed of a mixture very similar to the wearing surface of the Blome granitoid pavement. I am sorry to state that when it came to the closing of the contracts the commissioners could not see why they should allow this extra expense to the cost of the pavement, and cut out the liner altogether. Therefore, I have had no experience with a concrete liner, and can not state as to its success. It seems to me that a concrete liner properly constructed with a granite wearing surface ought to give satisfaction.

There are many advantages to be gained by this liner between the two pavements. There can not be a railroad constructed with absolutely no vibration. The vibration may be reduced to almost nothing on tangents, but there will be a pound at the beginning of the curves where the cars take the same.

I have often noticed cracks in the pavement, through the top and the base, radiating from the tracks at the beginning of the curves, even where the construction is very heavy.

A liner constructed of stone curbing will prevent this to a great extent. In fact, it so distributes the pound or vibration that there is small chance for the causing of cracks in the pavement.

And should the railway tracks need repairs or even an entire change in construction, the same can be made without harming the street pavement in the least.

As to the extra cost, this is more or less a delusion, and greatly depends upon the comparative costs between the pavement and the liner. Should the finished pavement cost $2.70 per square yard of surface, and the liner in place cost 10 cents per linear foot, it is a stand-off in the total cost, because of the amount of surface that is displaced by the liner.

COMPARATIVE ROAD TESTS AT CORNELL UNIVERSITY.

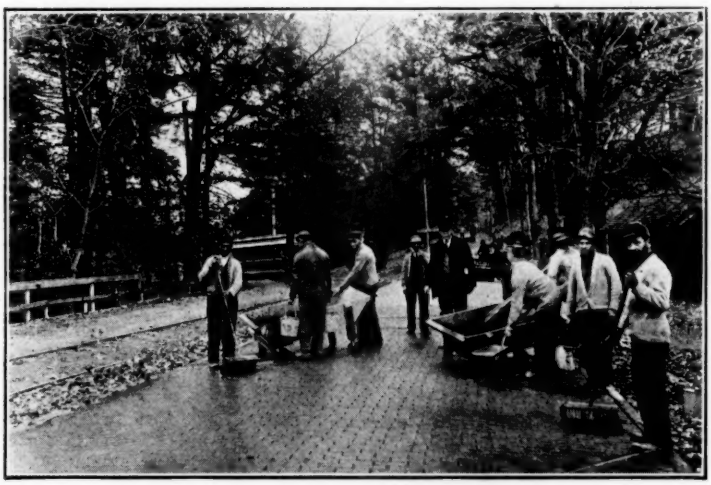
THE Office of Public Roads of the U. S. Department of Agriculture at Washington and Cornell University, under the special charge of Professor W. W. Rowles, are co-operating in a series of comparative tests of various materials for and methods of construction of suburban roads. The road selected is a typical one of this class in close proximity to the university grounds. The following is mainly abstracted from Professor Rowles's report on the construction of the road.

The stone used for foundations in the test pavements is Blakeslee limestone. It was also used for wearing surface except in the brick and slag sections. Where it is used for the wearing surface, excepting the concrete section, the test is mainly of the road oils and tars used in binding the materials together and of the methods of using them.

The bituminous binders were applied first by the penetration method, wherein the material, heated to a temperature of 200 to 300 degrees F., is poured on the stone and coats it, running into the layer of stone 2 or 2½ inches; and second by the mixing method, wherein the stone, thoroughly warmed until dry, is thoroughly mixed with the bituminous binder in a concrete mixer or on a mixing board, spread on the road and rolled down. See the article on "Bituminous Highway Construction" on another page of this number of MUNICIPAL ENGINEERING for a more detailed description of the two methods.

The general length of sections is 300 feet, with slight variations as

COMPLETED TEST BRICK ROAD AT ITHACA, N. Y.



TEST BRICK ROAD AT ITHACA, N. Y.
Applying Cement Filler.

noted. The details of treament of the sections follow.

Sec. 1, 300 feet long. Macadam stone road treated with Tarvia X by the penetration method. Tarvia X is a very heavy coal tar that will scarcely flow from the barrels. The stone after application of the heated tar is rolled, a thin coat of the same is broomed on and a coat of stone screenings is applied.

Sec. 2, 300 feet long. Tarvia X was used as a binder, the mixing method of application being used. Less tar is required and every piece of stone is thoroughly coated, and after rolling the bond between stones seems to be more perfect than in the penetration method.

Sec. 3, 300 feet long, is paved with brick laid on a dry limestone base, rolled, with limestone dust binder. The concrete curbs are 20 inches deep, and are 4 inches thick where there is no traffic and 6 inches where there is. The brick were laid strictly according to the specifications of the National Paving Brick Manufacturers' Association, under the personal superintendence of Secretary W. P. Blair, of that organization. Special care was taken to have a uniform 2-inch sand cushion, to lay, roll and tamp the brick carefully, to put in an asphaltum expansion cushion next the curb, and to put in the filler of 1 part Portland cement and 1 part clean sand according to the most approved method. Five different makes of brick were used. The two accompanying photographs show the application of the filler and the completed pavement. They also show characteristic views of the road. A street railway track runs alongside the road for a part of its length, but most of it is not thus encumbered.

Sec. 4, 300 feet long, is constructed with limestone and "bitos," an oil product even heavier than Tarvia X, by the mixing method. The 4-inch bottom course was thoroughly rolled with binder. Then 2 inches of the upper course was laid down and rolled and another course of stone mixed with bitos was laid down about 2 inches thick and rolled to a firm consistency. Under this section quicksand was encountered. It was removed to a depth of 18 inches and the sub-grade was filled with stone "shucks."

Sec. 5, 300 feet long, is macadam treated with Texaco by the penetration method.

Sec. 6, 300 feet long, is macadam treated with oil prepared by the Standard Oil Co., by the penetration method.

Sec. 7, 300 feet long, is macadam, but instead of filling the coarse stone with screenings, as in the standard macadam road, two inches of Kentucky rock asphalt was spread over the surface and rolled down as far as possible into the limestone. Kentucky rock asphalt is an asphaltic sandstone, and when it is crushed and ground every particle of sand is thoroughly coated with oil. When rolled a very smooth, hard, oiled surface is formed. At first the surface showed the imprint of horses's calks and even picked up, but only temporarily. It appears now to be equally impervious to wear and water.

Sec. 8, 300 feet long, is macadam reinforced with tar prepared for road purposes by the United Gas Improvement Co. of Philadelphia, by the penetration method.

Sec. 9, 300 feet long, is macadam treated with road oil supplied by the Indian Refining Co., by the penetration method.

Sec. 10 has a wearing surface 4 inches thick of open-hearth slag from Wickwire Bros. furnaces at Cortland, N. Y. For the first 100 feet of length the road tar of the United Gas Improvement Co. was applied and formed a satisfactory binder.

For the other 200 feet of the section no rolling would bind the bare slag satisfactorily. Not wishing to use clay, which is most commonly used with slag as a binder, quick-lime was tried. This material requires some time to show its action and meantime no definite report can be made, though the indications are that lime will be a satisfactory binder.

Sec. 11 for 270 feet is of macadam with the American Asphaltum and Rubber Co.'s asphaltum binder applied by the mixing method. After the treated stone was rolled down the surface was broomed over with a thin coat of asphaltum and limestone screenings were rolled into it to give the final surface.

The last 30 feet of the section were made of concrete of 1 1-3 parts of cement, 1 part of sand and 4 parts of cinders from the university heating plant, mixed in a concrete mixer, spread and rolled with a 500-pound roller. No surfacing was given the concrete.

Sections 12, 13 and 14 are each 200 feet long. The pavement is of concrete made of cement 1 1-5 parts, sand 1 part and limestone graded in two sizes 4 parts. This concrete was 4 inches thick and was laid on the same 4-inch limestone base as most of the

other sections. A 4x4-inch scantling was used to hold the edges in place.

Sec. 12, 200 feet long, is coated with the American Asphaltum and Rubber Co.'s asphaltum, filled with limestone screenings.

Sec. 14, 130 feet long, has the uncoated concrete surface.

The pavements were not all completed, and next season four sections will be laid using the mixing method with the same materials used this year with the penetration method. One new material will be used on a fifth section by the mixing method.

The brick pavement is, of course, not an experiment, and some of the other materials may be said to have passed the experimental stage. Good opportunity is offered for comparison of the various methods and materials, and it is to be hoped that the results will be of some practical benefit.

The question of cost is an important one, but it is doubtless true that the cost of laying these various sections will be no good measure of the cost of laying the same materials in regular work. No figures of cost are given in the report of Professor Rowles, and they would be greater than usual for the same materials and methods. This item in the comparison must therefore be supplied from other sources.

POSSIBILITIES OF THE USE OF MINERAL OILS MIXED WITH CONCRETE.

By Albert Moyer, Assoc. Am. Soc. C. E., New York City.

THE mixing of oil (mineral) with concrete is very simple. The oil, alkalies and water will form an emulsion, becoming thoroughly incorporated in the concrete. If the concrete is to be mixed by hand, proceed as usual, and after the water has been added, the resulting mass turned and raked, add non-volatile mineral oil in proportion of 10 to 15 per cent. of oil to the weight of the cement. Turn the concrete with shovels two or three times, raking while turning; the oil will quickly emulsify and become thoroughly mixed in the concrete.

If machine mixing is employed, use a batch mixer, turning a sufficient number of times to mix thoroughly the cement, sand, crushed stone or gravel and water. Then add 10 to 15 per cent. of non-volatile mineral oil. Turn again the same number of times as it requires to mix xthe concrete. The oil will quickly emulsify and become thoroughly incorporated in the concrete.

Oils added to concrete in proportions of from 5 to 15 per cent. will slightly delay the initial and final set. Increasing the proportions of oil will further retard both the initial and final set and hardening, but up to 15 per cent., from experiments so far made, it would seem that the retarding of hardening will not be sufficient to cause the work to be uneconomical.

The tensile strength will necessarily be reduced, and with the increasing percentages of oil toughness will be slightly diminished, but not in proportion to the increase in the percentage of oil used.

An exteremely interesting paper was read at the meeting of the Association of American Portland Cement Manufacturers, at the Hotel Astor, New York, December 15, 1909, by Logan Waller Page, Director Office of Public Roads, Agricultural Department, Washington, D. C., on the subject of "The Possibilities of Portland Cement as a Road Material," in which he described some investigations being carried on by Dr. Allerton S. Cushman in the laboratory of the Office of Public Roads to ascertain the practicability of mixing semi-asphaltic base oils with Portland cement concrete, with the object of obtaining the desirable properties of both Portland cement and asphaltum. So far only pats and briquettes have been made; the results so far obtained show ample strength for ordinary work; 6-inch cubes will be tested later.

It is believed that compression tests will show greater strength than the usual relation of compression to tension. This is a matter for further investigation, and it is to be hoped that chemists and cement testers will actively take up this work and carry on investigations covering long time periods.

Two months ago the writer made some briquettes and pats with the object in view of ascertaining if the mixture of oil with wet neat cement and

mortar would have the tendency of keeping all but the excess water from leaving the wet neat cement or mortar.

Briquettes were made, neat cement mixed with water, the water slightly in excess of that usually required, after which 10 per cent. of oil petrole was added. (Oil petrole is a white non-volatile petroleum product of about the consistency of melted vaseline.) Pats were made of 1 part cement, 3 parts sand mixed with water, a little in excess of what would ordinarily be used, after which 10 per cent. of the same oil was added. These pats are about 2½ inches in diameter and ¼ inch thick.

As soon as made they were left in dry air. The initial and final set were found to be normal. They were never immersed in water, but remained in dry air for several weeks. No cracks occurred, and they became so hard and strong that these pats, ¼ inch thick, were very difficult to break by the use of the fingers and thumbs. After remaining in dry air for three weeks they were put out in freezing temperature for three days, and again placed in dry air over the radiator. No cracks or checks have occurred.

After remaining in dry air for a month, a test for absorption was made. A broken pat was weighed dry and found to weigh 94-64 oz. It was then immersed in water for several hours. Upon removal from the water the surface water was quickly removed with blotting paper, the pat immediately weighed and found to weigh 99-64 oz. Only 5-64 oz. of water was absorbed.

The fact that the pats were never immersed in water and showed no evidence of checking or cracking, and became hard, would indicate that the emulsified oil had held the water in the mortar, and that such mortar was therefore both non-evaporative and non-absorbent, which would tend to show that concrete in which mineral oil has been mixed would not be likely to contract, and therefore contraction cracks would be avoided.

Furthermore, the resulting mortar appears to be far less brittle, and therefore such treatment should admirably serve the purposes required of concrete retaining walls, foundations enclosing cellars, tanks, cisterns, etc.

Exhaustive tests have been made by a number of authorities on the action of oils on concrete. The effect of oil on concrete and the effect of oil emulsified in concrete are two separate and distinct subjects. We are informed by reliable authorities that concrete immersed in animal or vegetable oils will in time disintegrate, and that concrete immersed in mineral oils is unaffected. In the first incent. grade, 40 feet width between curbs, and no railroad tracks.
stance there was no chance for the oil to emulsify; in the latter the oil is separated into minute globules.

A mere casual glance at the uses of Portland cement concrete would indicate that oils mixed with the concrete would prove very desirable for dustless waterproof floors for office buildings, for slaughter house non-absorbent floors, impervious concrete drain tile and sewers.

Contraction cracks will be eliminated in cisterns, drinking troughs, live stock feeding floors and platforms. Some objection may be raised to the use of oil mixed concrete from the standpoint of its liability to flavor the water or the food. If we stop to consider that the oil is divided into minute globules, thoroughly emulsified, we will see that while there may be some odor there is not likely to be any taste after the drinking trough, feeding floor or cistern has been in use for a few days.

Such oil mixed concrete will also be particularly adapted to terrazzo floors. The great objection at present is due to contraction cracks. A white oil may be mixed with Portland cement, white sand and water, and used for the purpose of setting brick and stone; it being non-evaporative and non-absorbent, no efflorescence or stains can occur. In fact, such concrete can be used in any work not requiring extraordinary compression strength, and in which the concrete does not come in contact with heat. One of the particular advantages will be for stucco work and exterior plasters.

Like many discoveries, this only proves to be a rediscovery. In the first century, A. D., Marcus Vitruvius Pollio, the famous Roman architect, gives the following detailed specification for stucco: "A mixture of well hydrated lime, marble dust and white sand mixed with water, to which mixture is added either hog's lard, curdled milk or blood." In A. D. 1280, at Rockingham Castle, England, melted wax was mixed with the mortar. In A. D. 1324, in the work of King Edward II, at Westminster, pitch was mixed with mortar.

The permanency of the Roman stuccoes may be partially accounted for by the use of oil mixed with mortar. Although Vitruvius used hog's lard, an

animal oil, the mortars have withstood the action of the centuries, and in places where freezing temperature occurs in winter and great heat in summer. However, the hog's lard must have been very thoroughly emulsified by the action of the hydrated lime. Portland cement was unknown at that period.

Lime, sand, and animal oils have stood the test of centuries; Portland cement and animal oils have not yet had this opportunity. It is within the range of possibility that the test of time may prove contrary to the theory and animal oils emulsified be found not dangerous, and we will then consider a remark made by a very noted chemist: "If theory conflicts with the fact, we will have to change the fact."

TOLEDO'S NEW WATER FILTRATION PLANT.

By B. M. Baker, Toledo, Ohio.

THE accompanying photographs show some of the more interesting features of this big $900,000 water filtration plant for Toledo, O., upon which work has been steadily progressing since 1906. Photograph I gives a view of the filter house, showing the location of the operating stand for operating the valves which control the flow of water to and from the filters. Each filter is entirely separate from its neighbor, thereby allowing the use of any number or quantity of filters to be operated at one time. These operating stands are a new conception, and bring the operator in close connection with the filter during the process of washing. There is also to be erected in front of each filter a movable stand on which gauges will be mounted to be used in connection with the filters. These are loss of head and pressure gauges, and also a gauge showing the operation of the rate controller. In the background of the photograph is shown the second floor of the main entrance to the building.

I. TOLEDO FILTRATION PLANT.
Filter House, Showing Operating Stands.

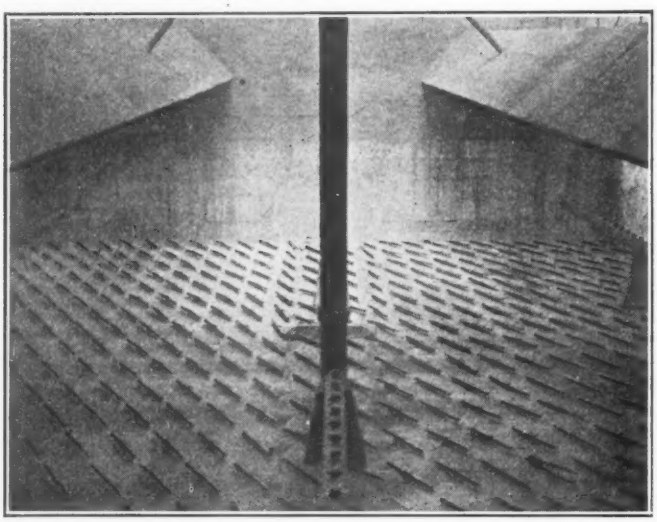
The filter house has a temporarily constructed wall at the west end which will allow of the extension of filters at any time, so that 10,000,000 additional gallons can be added to the capacity without changing the settling basins. Below the floor is the raw water duct supplying the filters.

Located directly beneath the room shown in the foregoing described picture is the pipe gallery, the most perfect pipe gallery which up to this time has ever been designed. Overhead is

the raw water duct and below the floor the clear water duct is located. This gives entirely free and unobstructed passageway the full length of the filters, all valves, pipes and rate controllers being located upon either side and easily accessible. The gallery is brightly lighted by electric lights, a bulb being located in front of each filter. The floors, beams and columns are heavily reinforced by concrete, care being taken to avoid shrinkage and cracks, thus preventing leakage. Vertical joints were left to be afterwards calked and made tight, the object being to confine the cracks to known places where they can easily be watched and kept in repair.

The next photograph shows the strainer valves in the bottom of the filters. These valves are small brass tees, screwed into cast iron laterals, these in turn being leaded into a cast iron pipe in the center of the bed, connecting from there to the pipe gallery. This cast iron pipe is covered with concrete to the bottom of the tees, thus minimizing the distance between them and the floor. The strainer valves are covered with fine saw cuts, permitting an easy flow of water and fine enough to prevent the sand from entering. These valves are in turn covered with 9 inches of gravel, graded from fine to coarse, the top of the gravel coming just below the horizontal air pipes shown in the picture. These air pipes will be a series of small brass pipes fastened into the small tees shown in horizontal air pipe mains, at right angles, thereby covering the entire bed. On top of this is located the sand, extending to the bottom of the wash troughs shown in the picture, the air being used in connection with washing filters to agitate the sand. The wash water enters the filters through the strainer valves, thereby reversing the flow of water during the process of washing, the wash water being supplied from pumps in the main building.

The clear water basin has groined arch roof and floor. In dimensions this clear water basin is 250 feet square, and is built entirely of concrete arches 5 inches thick at the crown. The basin is almost entirely under the natural surface of the ground. In order to make an air-tight floor as nearly as possible, it was cut up into 15-foot squares, each square or pedestal making a bearing for a column. These blocks or pedestals were built in alternate sections, steel plates being placed around the edges in building the intermediate sections. These plates were previously greased and drawn after the concrete was set, the opening left being filled with asphalt. This basin is connected with the clear water conduit, which flows along one side, by a 30-inch pipe controlled by a sluice gate, thereby allowing the water to go and come in the basin according to the rate of pumping in two stations. The clear water basin is covered with earth which is



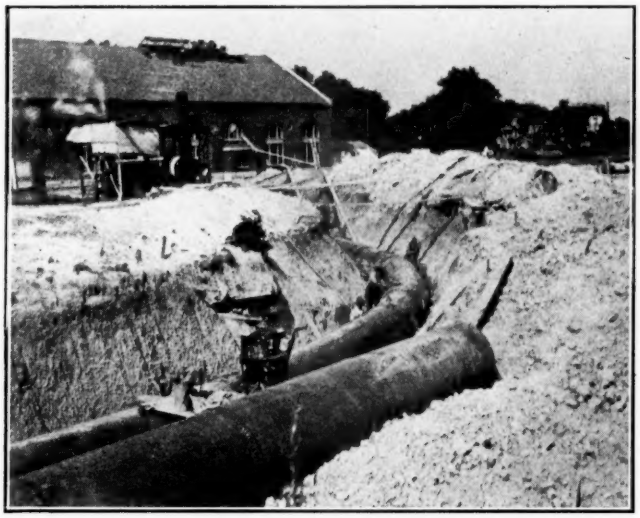
II. TOLEDO FILTRATION PLANT.
Collecting Pipes or Strainer Valves in Bottom of Filters.

18 inches thick at the crown, the pockets over the columns being covered with sand and gravel and provided with weep holes. The ground thus provided will be developed as a park with grass, flowers, walks and drives.

The main building is of concrete construction with sandstone accompaniments to the second story, which is of stained brick with sandstone trimmings and a tile roof, being in plan 51 feet by 275 feet.

The view of the supply pipe from the pumping station to the main building, Plate III, shows part of the pumping station in the background and one line of the pipe laid, the other pipe not being finished. This pipe consists of riveted steel, 42 inches inside diameter, coated with an asphalt mastic. This picture also shows the method of constructing a curve, great care being taken to protect the coating.

This riveted steel pipe, while much used throughout the west, is a new idea in this locality in such sizes laid underground. The authorities gave the matter considerable thought and investigation before concluding to use it in the filtration plant, but it was finally concluded to be the best for this purpose, being much cheaper, lighter and easier to handle than iron pipe, and it is believed durable enough to last until a new plant is needed to keep up with the march of progress and fulfill the ideas of the coming generation.



III. TOLEDO FILTRATION PLANT.
Riveted Steel Supply Main. Power House in Background.

THE CHARACTER OF STREAM POLLUTION AS AFFECTING PURIFICATION PLANT DESIGN.*

By H. E. Jordan, Chemist of Indianapolis Water Company.

THERE are two controlling factors which enter into the design and operation of all water purification plants. The first is the character of the raw water supply, as affected by the various forms of stream pollution which have entered previously, and the second is the necessity for the production of a finished product of relatively uniform character; and by the term "relatively uniform character" is not only meant the uniformity so far as

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local conditions are concerned, but also a general uniformity as regards all cities having public water supplies, for it is a recognized fact that in the travel of persons from one place to another they are constantly comparing the quality of one drinking water with another, and by their statements and comments are influencing the opinions of the consumers of any supply as to character.

The quality of the raw water supply as taken at any purification plant in this country at the present is, of course, modified by the discharge of various forms of domestic and factory wastes into the water courses, and one of the questions which has always been a source of contention between water supply organizations and up-stream municipalities or corporations is the degree to which those up-stream shall purify their wastes. Within the last few years the question appears to have resolved itself into a sort of agreement to the effect that sewage or waste purification shall simply consist of such operations as will render the effluent relatively free from suspended matter and not liable to putrefy when discharged into a running stream. The further considerations of bacterial removal and the refinements as to color, taste and suspended matter are to be left to the water purification plants.

Stream pollution, as to the character of the material, may be roughly classified into mineral and organic pollution. By the term "mineral pollution" is meant such things as suspended clay and sand. Under the class of "organic pollution" may be placed most all of the domestic and factory wastes, along with colors and odors sometimes produced in water supplies by swampy water-sheds or growths of algæ. The methods of removing these are best illustrated not by technical discussion of the character of each and the theoretical process which might be applied in this removal, but by definite illustrations of water purification plants which have been forced to meet these different problems.

As an example of a water purification plant satisfactorily operating with a water of relatively low turbidity and color, but somewhat affected by domestic sewage, there is the filtration plant at Lawrence, Mass. This probably, in a great many of its characteristics, represents the simplest form of a plant which may be used for water purification, consisting simply in a series of slow sand filters, operating at a normal rate of two and one-half to two and three-quarter million gallons per day, and producing a water perfectly satisfactory in point of its bacterial content. The absence of any extreme fluctuations in point of suspended matter and color render it unnecessary for any preliminary treatment to be used. The investigations which have been conducted from time to time at the plant have indicated that rates as high as five or six million gallons per acre may be used, and at the same time produce an effluent of practically the same quality.

On the Hudson river the purification plants at Albany and Poughkeepsie, both in their likenesses and differences, are interesting as examples of modifications which differing characters of stream pollution necessitate in the design of the plants. At Albany the Hudson river is very considerably affected by the presence of domestic sewage, which not only has produced a high bacterial content, but a considerable proportion of organic matter in solution. There is also a slight amount of color and suspended matter in the river at this point. The original installation at Albany consisted of eight covered filters, preceded by a settling basin of a rated capacity somewhat less than a day's supply. The operation has always been very successful so far as would be indicated by the improvement of the public health conditions; yet there was during the operation of the plant under these circumstances a bacterial content produced at certain seasons of the year which in point of numbers was excessively high. At the same time the operation of the plant from a mechanical standpoint was becoming constantly more difficult, on account of the deposition of suspended matter within the lower sand layer. The modification made in 1907 consisted in the construction of a series of roughing filters, which are situated between the settling basin and the final filters. In point of general design they are very similar to the conventional mechanical type, but operate without the use of any coagulant. It has been possible by their operation to remove the difficulties which were encountered in the sub-surface clogging of the slow sand filter layer, and at the same time to increase the ordinary rate of operating so as to produce from two hundred to two hundred and fifty million gallons per acre between cleanings, instead of approximately ninety, as was the case before the modification, and at the same time these changes have been accompanied by a general reduction of the bacterial content of the filtered product.

At Poughkeepsie, N. Y., further down

the same river, there is situated one of the older filtration plants of the country, which had operated for a number of years on the same general lines as the Albany plant, with a raw water of slightly lower average bacterial content, but had become involved in some of the same difficulties as to abnormally high bacterial content at certain times, and operating difficulties, so far as cleaning and maintenance of the sand layers were concerned. At this place there has been added to the settling process the additional feature of coagulation, and at times of extreme turbidity the raw water is treated with sulphate of alumina, allowed to pass into the settling basin, where the suspended coagulant and clay are allowed to settle out, and from thence passed to the filters. It has been the case here, as was the case at Albany, that by the pre-treatment process those features of the stream pollution which were rendering the operation of the plant erratic have been successfully removed.

These two plants represent a filtration system which is forced to deal with a water somewhat polluted by pulp wastes, highly polluted by domestic sewage, and moderately affected by varying amounts of suspended matter. The results from the two plants indicate that with the modifications that have been recently made the purification and mechanical and cost efficiencies are satisfactory. It is not possible at this time to reach any conclusion as to the relative efficiency of the modifications at these two plants, because the operation has not extended over a sufficiently great period of time.

At Little Falls, N. J., in 1902 there was installed a mechanical filter plant which was probably the first one of particular note in this country to be constructed to handle waters which might not be classed as turbid. At Little Falls the raw water supply is principally affected by an abnormal color, due to the presence of a large amount of vegetables extractions which have been picked up in the upper stream flow through swampy regions. It has been an admitted fact that the operation of slow sand filters is not markedly successful in the removal of color, while the use of such coagulants as sulphate of alumina has been successful. The operation of the Little Falls plant has justified the expectations of those who designed it, and it has been possible to satisfactorily reduce the color and at the same time produce a water of sufficiently stable and low bacterial content to insure its healthfulness as a source of supply.

The Potomac river at Washington represents a stream of somewhat different character as to the nature of its pollution from these above mentioned. In this case, although there is a large amount of domestic sewage flowing into the stream above Washington, the characteristic feature of the stream pollution is the large amount of exceedingly fine suspended matter, due to the erosion of the soil in the upper stream flow. At this place there was constructed a slow sand filter plant, which received its supply from a series of reservoirs, so arranged as to give ordinarily about six days' settling. It has been found in the course of the operation that although the plant was quite successful as a remover of bacterial life, the complications resulting from the persistence of very fine suspended matter, even after so long a period of settling, rendered the operation of the plant somewhat difficult. Extensive investigations have been made by Hardy and Longley at this place, and it has been recommended that a coagulant be applied to the water at a certain stage in the process of settling, so as to remove these finer particles of suspended matter. Experimental data which have been accumulated indicate that such process will, with the remaining amount of sedimentation, effectively remove all of the disturbing elements which have been at the plant, and enable slow sand filters to operate successfully.

At Harrisburg and Steelton, Pa., are met two plants dealing with another character of stream pollution. The Susquehanna river, which is the source of supply for both, is somewhat affected in its upper area by coal mine wastes and suspended matter at time of excessive rainfall. So far as the bacterial content of the Susquehanna water is concerned, it apparently would be possible to saisfactorily purify this by slow sand filtration if it were not for these results of deforestation and industry, but with these complications it has been necessary to modify the method of purification. At Harrisburg there has been installed a mechanical plant with a coagulation basin so arranged that at times of excessive turbidity it may be partially used as a means of plain sedimentation, and then, after a certain period, the water treated with coagulant and passed to the filters. The difficulty in the operation at Harrisburg seems to have been due to the fact that although there are seasons of the year when the suspended matter is so excessively high as to render the purification best done by a me-

chanical plant, there are other seasons when the suspended matter is practically a minus quantity, and the other factors of bacterial content and proportion of organic matter so low that there is no basis upon which satisfactory mechanical filtration can be carried on. On account of this fact it was necessary at different times for clay to be added to the water entering the plant, in order that the coagulant might successfully form and assist the operation of the mechanical filters.

At Steelton, Pa., the development of the purification plant has been somewhat different. There is first a grit chamber, followed by a roughing filter, and that in turn by slow sand filters. The idea of operation is briefly this: that at times of low turbidity the roughing filters will be used to remove a portion of the bacterial life and practically all of the suspended matter, and the slow filters simply used as a means of finishing the product. At time of high turbidity the grit chamber is effective as a remover of the coarser suspended material. At the same time there is added to the water a certain amount of coagulant, which, collecting together the suspended particles, is removed by the roughing filters. Their effluent at this time is somewhat higher in point of suspended matter and bacterial life than at times of low turbidity, and in this case the work of the sand filters becomes more directly comparable to those conditions which are met in the plain sand plant at Lawrence, Mass.

In and about Pittsburg, Pa., there are three filtration plants operating on river waters of somewhat similar characters. The supplies as provided at McKeesport, Pittsburg and South Pittsburg are all taken from rivers at normal seasons slightly affected by suspended matter, but highly polluted by domestic sewage. At times of rainfall the erosion of the soil on the sloping hillsides produces a great amount of suspended matter. The abrupt fall in the stream flow is also responsible for a very rapid carriage of sewage from up-stream points down past these cities. There is the further effect of industrial wastes particularly characteristic of this district, in the presence of acids from coal mines, and large amounts of iron from the various steel plants. The result of these various polluting factors has been to produce a water supply at times of low water excessively hard, sometimes acid in character, and containing large amounts of iron, ordinarily as sulphate. At times of excessive rainfall these conditions may be somewhat lost sight of in the large amounts of turbidity, and at all times there is the controlling feature of the purification process in the necessity of removing large amounts of sewage. Although there has been some extremely valuable study made upon the treatment of these raw waters, the results of operation indicate that as yet the problem has not been completely solved.

At McKeesport the filtration plant is combined with a softening process, where by means of the customary chemicals, lime and soda, reduction in hardness is effected, and on account of the presence of the dissolved iron the water is subjected to coagulation, which, after some sedimentation, produces a product almost free from suspended matter, which is then passed through mechanical filters. At Pittsburg there is provided a settling basin of approximately eighteen hours' capacity, followed by slow sand filters, which operate at a maximum rate of two and three-quarters million gallons per acre. It is, of course, not possible for this plant to effect any modification in the character of the water, so far as the industrial wastes are concerned, and the conditions as to hardness and acidity, if present, remain in the finished product. The controlling difficulty apparently in all of the plants is the extreme rapidity with which fluctuations occur in the raw water supply. The large volume of industrial wastes, varying from time to time, and the extreme modifications produced by rainfall, effect a rapid change in the river water, and at all of the plants these changes must be immediately met by a modification of the operation, if the difficulties are to be overcome. It will be recognized that in these instances the requirement as to the proper disposal of factory and domestic wastes is not being met in this district, and that with this accomplished there will be a certain modification in the conditions described. There is, on the other hand, a certain question as to whether the magnitude of these various industries does not make it more advisable to improve the purification processes a little more greatly than would be the case under different conditions. The difficulty of rapid fluctuation could be met by the provision of large impounding or settling reservoirs, and this would assist greatly in the production of a uniformly purified effluent.

At Toledo, Cincinnati, Louisville and New Orleans the character of stream pollution is notably one of suspended

matter. The various conditions as to bacterial content and color are lost sight of in the continuous and high amount of turbidity, and the operation of the plants is, in general, successful, if by the conventional operation of mechanical filters the turbidity is removed. There are, of course, various modifications at the different plants along the line of individual preference, but in all there is the general division into the settling, coagulation and rapid filtration processes.

The Indianapolis plant, in certain conditions, is quite comparable in the character of its raw water supply to the installation at Harrisburg and Steelton, where the raw water is, during a large portion of the year, quite free from turbidity, and at other times subject to considerable amounts. There is no difficulty here on account of coal mine or industrial wastes. The design and operation of these three plants, as a matter of fact, seem to be leading toward the same general design, although the original installations have been somewhat different. Although the Harrisburg plant is a mechanical one, it has confronted the difficulties, as stated previously, of insufficient amounts of suspended matter to render its operation successful at certain seasons of the year. The Steelton plant is, perhaps, the most thoroughly hybrid of any filtration plant in the country, in that it represents all the different modifications between mechanical and slow sand filtration. The Indianapolis plant, on the other hand, may be characterized as a slow sand filter plant, modified by preliminary process of sedimentation, and further modified at times of excessive turbidity by the coagulation process.

It is a long step in water purification from the plant at Lawrence, Mass., to the one at St. Louis, Mo., and yet it will be recognized, as a person studies the modifications of water purification in travel from the east to the western portion of the United States, that they have been gradual, and from a slow sand filter plant operating with a raw water of moderate bacterial content and low amounts of suspended matter and color, we perhaps reach the best known example of the other condition at St. Louis, where the raw water supply is affected by extreme and persistent amounts of suspended matter of relatively coarse size, and the removal of which constitutes the essential feature of the purification process. At St. Louis, as is also the case at Kansas City and a number of plants dealing with water of this same character, the purification is effected by coagulation, the effect of the process being that on account of the excessively coarse size of the suspended particles the settling following coagulation is extremely rapid and thorough, and at all of these places, although the sentiment as to the necessity of further treatment by filtration is somewhat different, the opinion on the part of the users of the supply is one of satisfaction at the removal of the grosser pollution.

It is not possible to leave out of further consideration the modification of purification plant design which is being effected by the development of the use of hypochlorite of lime as an agent in reducing the bacterial content. The operation of filter plants in times past has always hinged more or less upon the fact that reduction depended upon the accumulation in the sand layer of a certain bacterial growth. Differences as to growth at different seasons and various rates of operation have always given difficulty in the production of a uniformly purified effluent with this more or less uncontrollable agent. It has been developed in practice that colored waters may be reduced in that characteristic by the use of coagulant and the proper sedimentation and filtration; that turbid waters may also be improved as to that characteristic by the use of coagulant and sedimentation alone, or filtration. The variations above mentioned, however, made it always a more or less uncertain question as to what results would be attained in the removal of bacteria. It is in this regard that the use of hypochlorite of lime is valuable. This material is an unstable combination of lime with oxygen and chlorine, which in solution breaks up and, as used in water purification, becomes an active oxidizing agent, reducing the organic life and destroying bacteria. Unlike many other materials which might be used in the same way, there is no residual product of which there can be any complaint made, the result being a slight increase in the amount of carbonate of lime present in the water. Its use as a means of sewage purification has been well known for some time, but as an adjunct to water purification its use must be dated from the work of Johnson and Jennings at the Stock Yards plant in Chicago. This installation is one where the raw water is nothing more nor less than dilute sewage, and by means of coagulation, mechanical filtration and hypochlorite the finished product is favorably comparable to the supply furnished by the municipality of Chicago. Since the work at this

plant the development of its use has been well-nigh universal. The water supply for Jersey City is an impounded one, very slightly affected by any pollution other than small amounts of bacterial life. It has been satisfactorily relieved of this by the use of a small amount of hypochlorite of lime. At Little Falls, N. J., and Harrisburg, Pa., the use of hypochlorite has made it possible to reduce the amount of coagulant used in connection with the mechanical filters, and at the same time producing a finished product of more uniform character. Experimental data accumulated at the Torresdale plant in Philadelphia, and at Albany, N. Y., indicate that it is applicable as an adjunct to roughing filtration. Studies by Gage at Lawrence, Mass., in fact, indicate that the Merrimac river water, which is the supply for the Lawrence plant, could be satisfactorily purified by the use of filters operating without coagulant, at rates of one hundred million gallons per acre per day, in which the bacterial reduction would be effected by the application of hypochlorite just before filtration. Its use in connection with the clarification of extremely turbid water as an agent of minimizing the amount of bacterial life has been demonstrated to be successful. In all of these various operations where this material has been used as an adjunct to the purifying process, the additional cost which it incurred is so slight as to be almost a negligible quantity, generally running from 10 to 25 cents per million gallons of water purified. Although the use of any new means of water purification has always been and probably will be accompanied by certain mistakes of over-anxious experimenters, there is no question that the use of hypochlorite will become practically universal, and must be taken account of in future designs of purification plants.

The modifications, then, that varying characters and degrees of stream pollution necessitate in the design and operation of a filtration plant are quite apparent. Experience at these plants, as above noted, indicates that in the case of water slightly affected by color, suspended matter and bacterial life, plain slow sand filtration is entirely adequate. Water of this character, as developed by the experiments of Gage, may also be handled by rapid filtration, preceded by the use of hypochlorite. For water affected by dissolved color, mechanical filtration preceded by the use of sulphate of alumina is most effective. Water of the character such as is met at Albany and the Torresdale plant at Philadelphia, high in bacterial life and organic matter, is best treated, not by any means of single filtration, but by settling, roughing filtration and final slow sand filtration. In these cases it appears that the additional use of hypochlorite will make it possible for the process to be very much condensed, and it is probable that the final slow sand filters may also be operated more nearly at mechanical rates or entirely eliminated.

The modification of purification systems due to suspended matter, of course, depends altogether upon its duration and intensity, and may be successfully handled by installations in all degrees of difference between such a one as is installed at Washington and the pure mechanical type such as at Cincinnati.

Finally, those waters carrying constant and high amounts of suspended matter of coarse size are satisfactorily purified by coagulant, sedimentation, and the recent modification of the use of hypochlorite.

The progress in water purification during the last fifteen years has been rapid, although the difficulties that investigators have had to meet were great. The recent developments of the use of bleaching powder and the increased knowledge as to the value of roughing filtration seem to indicate that within the next decade the problem of satisfactory water supply will reach a very definite and satisfactory conclusion.

EDITORIAL COMMENT

Pollution of Inter-State Streams

Nominations for Office Under the Commission Plan of Municipal Government

POLLUTION OF INTER-STATE STREAMS.

Inter-state streams are of two classes: Those which flow for a portion of their length through one state and then pass into another state, and those which form boundaries between states. In either case pollution of the stream in one state is liable to produce damage in another state. Thus far there has been no apparent method of dealing with a case of this sort.

The state of Ohio has made a thorough study of this matter, especially in connection with the pollution of the Ohio river, and the Attorney General has given an opinion to the effect that the U. S. Government can give no relief so far as pollution coming from another state is concerned, but that the laws of the state control pollution of the Ohio river within the state, so that a city whose water supply is contaminated by any other city or industry within the state can take the necessary steps to stop the pollution.

The law passed by the Indiana Legislature last year is not so inclusive, for it expressly excepts from the operation of the law cities on streams along the boundaries of the state which are polluted from sources outside the state which are permissible under the laws of the other state.

The state of Ohio is encouraging a movement toward co-operative action among the cities along the Ohio river. Joint meetings have been held with representatives of some of the states, and others have expressed their desire to co-operate. The Ohio resolution, which is approved by Pennsylvania and West Virginia, is to the effect that the respective legislatures should enact a law to prevent the introduction of any additional sewage into the Ohio river or any of its tributaries which affect the water supply of any municipality. The passage of such law by Pennsylvania and the states west of it, bordering on the Ohio river, would do much to show what the states themselves can do in protecting each other. It is one of the pieces of uniform legislation toward which the states generally are working as the only method of solving some very vexing problems.

NOMINATIONS FOR OFFICE UNDER THE COMMISSION PLAN OF MUNICIPAL GOVERNMENT.

There are now several methods of securing candidates for municipal offices in use under the various forms of the commission plan, and some comparison of a few of them may be of interest.

If Memphis may be considered the original city adopting the commission plan, the earliest method of nominating candidates was by the regular party machinery.

The first modification was nomination by petition, reducing the number of elective officers to four or five, who, after election, should determine which offices they should fill, the same body having the duties of supplying the necessary funds and spending them. In some cities the number of names required on the petitions for nomination is large enough so that the number of candidates is automatically reduced to the minimum, including only those who really want the offices or represent some principle or movement of sufficient importance and interest to induce citizens to put forth the effort necessary to get the signatures. In others, such as Berkeley, California, a college town, the number of names required on a petition is only twenty-five, so that there may easily be an indefinite number of candidates.

The latest developments of the commission plan approach the older plans

in some degree, Boston, for example, electing a mayor and a council, putting into the hands of the council the legislative matters and into the hands of the mayor the administrative matters, the latter appointing the boards or individuals put in charge of the various departments. Berkeley elects mayor, auditor and councilmen.

The earlier forms, most of them applied to cities of some size, provide that the persons receiving the highest numbers of votes shall be elected. But where the number of candidates is practically unlimited, this might result in the election of persons representing only a small proportion of the population. In Berkeley, therefore, it is required that no one shall be declared elected unless he has received a vote greater than half the number of votes cast. In case this causes failure of choice at the first election, a second election is provided for three weeks after the first election. At this election the number of candidates is reduced to two for each office, being the two receiving the highest numbers of votes at the first election. If four out of five councilmen were not elected at the first election, for example, then the eight not receiving majorities who were next highest in the polls would be the candidates for councilmen at the second election.

The methods at present in use may be grouped in general classes, overlapping somewhat, as follows:

1. Nomination for general legislative and administrative service, particular service assigned after election.
2. Nomination for special service, legislative or administrative.
3. Nomination for legislative and head of administrative offices and later appointment of department heads.
4. Nomination by petition with large number of signers.
5. Nomination by petition with small number of signers and an election which is in effect a non-partisan primary in case a candidate does not receive a clear majority.

The objections to the lottery authorized under the first class have already been stated. The second class removes one of the elements of the lottery, since the candidates are nominated for specific offices, but either political nominations or nominations by petition may fail in putting up proper candidates for strictly technical administrative offices or in electing them if nominated. The responsibility is also distributed too widely if each official is responsible directly and independently of the head of the government to the voters only. The third class of cities seem to have the arguments in their favor, and the facts also, so far as their influence is not modified by errors in methods of nomination included in the fourth and fifth classes.

The purpose of the present article is to call attention to the effects of the methods of nomination in these two classes.

Boston has recently held its first election under a charter falling in the fourth class. There were four candidates for mayor and the successful candidate secured not quite half the total number of votes cast for the office. Many citizens point to his former administration as evidence of his unfitness for office, but the fact remains that he did receive nearly half of the votes cast. There was the unfortunate division of strength between two good candidates which so often occurs, the vote indicating that if one of them had not run the other would have been elected. It is undoubtedly true that the city of Boston gets the best government that the majority of its citizens wants, and deserves what it will get. It is also probably true that the vote of the majority was so scattered that it did not have its full effect. And the question arises as to how it can secure the full results of its real power if that power is rightly applied.

The non-partisan primary included in the fifth class of nominations suggests a possible remedy. This has been applied in a small city, Berkeley, which has the further advantage of being a college town, so that the method must be applied with care in a larger city, in particular. The first election is not called a primary, but is the municipal election, and if any candidate has a majority of the votes cast he is elected at this first election. Thus at one elec-

tion there were four candidates for mayor, and one was elected and took his office on the strength of this election. If, however, no candidate had secured a clear majority, as in the Boston case, the two receiving the highest number of votes are termed the nominees for the office and a second election is held three weeks later, at which one of the two must be chosen.

It would have been possible, had this method been applied in the Boston case, for the "good citizens" to come out and vote at the second election for their one candidate and thus elect him. However, the size of the poll at the second election must be considered. The first election is the most important, and will probably draw the largest vote. In Berkeley at the election mentioned it was 25 per cent. greater than that at the second election. The stay-at-home vote at the second election is likely to be taken from the so-called "good citizen" class, and demonstrates poor rather than good citizenship.

On the other hand, the city of Memphis at a recent election, when the mayor was the only officer elected, showed the utmost interest in this, its first non-partisan election, and cast the largest vote in its history.

The expense of an election is great in a large city, and this must be considered in preparing for a possible double election. The expenses of candidates and of their machinery are still greater in a large city than in a small one where practically every candidate is well known by most of the electorate.

One way to diminish some of the difficulties in municipal elections would be to limit the franchise to the stockholders in the corporation, i. e., those who have enough property to find a place on the tax list.

THE QUESTION DEPARTMENT

Books on Electric Light and Gas Plants.

Can you refer me to good books that will assist me in making plans and specifications for an electric lighting system and a gas works for a city of 10,000 inhabitants. I want the latest on the two subjects, that will enable me to provide the best lamps, wiring, machinery and distribution and the proper sizes and proportions of gas machinery, holders, distributing mains, etc. What can you refer me to in MUNICIPAL ENGINEERING on the subject?

E. B. D., City, Engineer, ——, Ind.

Good books on electric lighting are Houston and Kennelly's "Electric Arc Lighting" ($1) and "Electric Incandescent Lighting" ($1)); Atkinson's "Elements of Electric Lighting" ($1.50); Cushing's "Standard Wiring for Electric Light and Power" ($1); Wiener's "Dynamo Electric Machines" ($3); Crocker's "Electric Lighting" ($3); "Distributing System and Lamps" ($3).

The latest American book on gas making is Latta's "Handbook of American Gas Engineering Practice" ($4.50). Good recent English books are Newbigging's "Handbook for Gas Engineers and Managers" ($7); and Hole's "The Distribution of Gas" ($4). A longer list will be found in vol. xxxv, p. 35. American books on gas manufacture are scarce.

The new electric and incandescent gas lamps have not yet reached the textbooks. Articles concerning them and other branches of the subject of lighting of interest in connection with the question will be found in recent volumes of MUNICIPAL ENGINEERING as follows, with some others in this number:

Vol. xxxviii: "Street Lighting," p. 15; "Arc and Other Electric Lights," p. 44.

Vol. xxxvii: "Municipal Gas Plant Experiences," p. 315; "Modern Lighting System for Mishawaka," p. 115.

Vol. xxxvi: "Tungsten Lamps Compared with Arc Lamps," p. 216; "Quality of Gas," p. 286;' 'Forms of Contract for Electric Current," p. 316; "Municipal Street Lighting Plant," p. 373; "Rates for Lighting and Contract Provisions," p. 33.

Vol. xxxv: "The Arc Lighting System of Portland, Ore.," p. 234.

Vol. xxxiv: "Flaming and Metallic Arc Lamps," p. 235; "Tests of Electric Lamps," p. 306.

Vol. xxxiii: "Improvements in Electric

Lamps," p. 388; "Comparison of Electric Lighting Systems," p. 348.

Vol. xxxii: "The Municipal Electric Light Plant of Hagerstown, Md.," p. 291; "Data on Municipal Ownership of Water and Light Plants," p. 98, giving references to many previous articles.

Officers of National Electric Light Association.

Please give me the address of the secretary of the National Electric Light Association or where or how I may get a copy of the standards they have adopted for the various kinds of machinery used in electric lighting.

E. B. DOUGLASS, City Engineer,
Seymour, Ind.

The officers of the National Electric Light Association are Frank W. Frueauff, Denver, Col., president, and Frank M. Tait, Dayton, O., secretary and treasurer. The association also has headquarters in the Engineering Building, 29 W. 39th St., New York City.

Distribution of Charges for Electric Power.

Would you kindly furnish solution of the following question through the medium of your valuable periodical.

A municipal power plant furnishes three departments with energy, each having load factors as follows: 40, 32, 15. The total cost per unit of energy, including fixed charges is 5 cents, determined by dividing the total monthly cost, which includes proportion of fixed charges, by the total monthly output of energy.

We wish to be instructed in the proper manner of dividing this unit cost, taking into consideration the load factors. If you do not consider this method feasible please state some method of division which is more practicable and correct.

SUBSCRIBER,
————, Alberta.

It is assumed that the power named is electric power.

This subject was quite fully discussed by the Wisconsin Railroad Commission in the case of the Menominee and Marinette Light and Traction Co., decided Aug. 3, 1909, and reference can be made to the printed decision for details.

An electric power plant must be large enough to carry the entire load which can come upon it at any time. The maximum capacity is reached by the output but a few minutes during the day. The remainder of the time the machinery is operating well below its capacity, and it may indeed not operate during a part of the day. In like manner a customer of the plant may operate at his maximum rate but a part of the day and at a lower rate the rest of the day, or may stop entirely for several hours in the twenty-four. He must, however, be able to get his maximum power at any time that he wants it, at least within the terms of his contract.

It is evident, therefore, that a part of the cost of operating the plant, including maintenance and capital charges, is dependent on the required capacity to meet the maximum demands of its customers, independently of the actual output, and that a part is dependent upon the output of current.

The decision referred to goes into detail regarding the various items of capital charges, maintenance and operation, distributing them between the two classes of charges, with reference to both steam and water power, as applied to power plants in general and to the particular plant covered by the decision.

The result is the statement that about 50 per cent. of the total cost should be assessed on the basis of the maximum capacity required, and the other 50 per cent. should be a regular charge per unit of power delivered. There are differences of opinion varying between 70 and 100 per cent. as to the proportion of the overhead charges, such as interest, depreciation and taxes which should be assessed as a capacity charge. These differences would vary the proportion of the total cost to be assessed as a capacity charge from about 47 to about 57 per cent.

For a power plant, therefore, the process of determining the charges to customers would be about as follows:

Determine the total cost of power sold during the month, including all capital, maintenance, depreciation and operation expenses.

Divide this cost by two.

Take the sum of the capacities of the motors connected under contracts and divide the half cost by this sum. This would give the cost per horse power per month, which may be stated on the rate card per day, per month or per year, as preferred. The profits are all included in the capital and depreciation charges provided for. This will be the charge per horse power of capacity of the motors attached to the circuits. When the current is used for lighting the equivalent charge per arc, incandescent, carbon or other light will be made.

Take the number of units of power actually sold during the month and divide the other half of the cost by this number. This will give the charge per unit of power to be made for current used.

The output will vary from month to month, but the overhead charges will vary but little. The receipts from the charge per horse power of capacity will not vary as long as the customers do not change their contracts and these practically constant overhead charges will, therefore, be met by a constant income. The operation charges will vary with the output of current, and the income will vary in the same way. The two will not vary in exactly the same proportion, however, so that it will be necessary to make a charge per unit of power delivered, which will insure sufficient return to pay all cost.

In the case of the Menominee and Marinette Light and Traction Co., the power rates worked out are 50 cents per month for each horse power of nominal rated capacity of motor, or less, and 3.5 cents per kilowatt-hour for current consumed.

For lighting, the active connected load, corresponding to the nominal rated capacity above, is assumed to be 60 per cent. of the total connected load for business or commercial lighting and 45 per cent. for residences, except in cases where the actual demand is known. The rates are 13 cents per Kilowatt-hour for the first 30 hours' use per month of the active connected load, 8 cents per kilowatt-hour for the second 60 hours' and 4.5 cents per kilowatt hour for each additional hour's use per month.

For any other plant the percentage distribution and the rates must be worked out from a study of the conditions of the individual plant.

Books on Town Engineering, Bridges and Roads.

Please send me a list and prices of practical books on engineering for small towns, road building and small bridges of steel and concrete; books that tell how more than why.

F. F. W., Lumberton, N. C.

Following is a list of books on the subjects named with some notes on their contents:

McCullough's "Engineering Work in Towns and Small Cities" ($3) is the book most nearly fitting the first item.

Spaulding's "Text-book on Roads and Pavements" ($2) is the latest book on this subject and the only one giving much detail on the latest bituminous macadam roads.

Judson's "Road Preservation and Dust Prevention" ($1.50) gives practical details in treatment of road surfaces.

Byrne's "Highway Construction" ($5) is the most detailed American book on road building.

Taylor and Thompson's "Concrete, Plain and Reinforced," ($5) gives many practical details on construction of large and small reinforced concrete bridges.

Buel and Hills' "Reinforced Concrete" ($5) and Gillette and Hills' "Concrete Construction Methods and Cost" ($5) also give many detailed examples.

Tyrrell's "Concrete Bridges and Culverts" ($3) is a new book which should meet our correspondent's needs.

A list of books on roads and pavements will be found in MUNICIPAL ENGINEERING, vol. xxxiii, p. 339. Lists of books on cement and concrete, some of which contain information on reinforced concrete bridges, will be found in vol. xxxii, pp. 306, 380. Following are additional books on the subjects mentioned in the question:

Whinery's "Municipal Public Works" ($1.50), on their inception, construction and management.

Goodhue's "Municipal Improvements" ($1.75).

Morrison's "Elements of Highway Engineering" ($2.50), a college text-book omitting most of the details.

Smith's "Dustless Roads, Tar Macadam" ($3.50) by the city surveyor of Edinburg, Scotland.

Phillips and Byrne's "Highway Construction" ($1), giving modern methods for road builders and all interested in better ways of communication.

Ryves's "The King's Highway" ($2) is an excellent English book.

Turneaure and Maurer's "Principles of Reinforced Concrete Construction" ($3.50), the most practical book on the theory of reinforced concrete.

Brown's "Handbook for Cement Users" ($3).

Reid's "Concrete and Reinforced Concrete Construction" ($5).

Watson's "General Specifications for Concrete Bridges" (50 cents).

Asphalt Contractors.

Kindly give us the name and address of a contractor who is familiar with the cost and also the method of constructing asphalt pavements. Please give us the name and address of your city engineer.

C. O. T., Sullivan, Ind.

Reference may be made to the "Business Directory" published in each number of MUNICIPAL ENGINEERING under the headings "Asphalt," "Asphalt Pavements" and "Contractors" so far as they use asphalt, for names of such contractors. H. W. Klausman, 410 Majestic Building, is the city engineer of Indianapolis.

Officers of Good Roads Associations.

Kindly advise the writer of the address of the secretary of the American Road Makers Association, also of the International Road Congress at Paris, France; and if you know when the next meetings will be held for these two associations, kindly advise date.

F. B., Minneapolis, Minn.

The officers of the American Road Makers' Association are James H. MacDonald, State Highway Commissioner, Hartford, Conn., president, and E. L. Powers, 150 Nassau St., New York City, treasurer. The time and place of the next convention haveno t yet been announced.

The principal official connected with the Second International Good Roads Congress, to be held at Brussels, is M. Mahieu, 1, Avenue d'Iena, I, Paris, General Secretary of the Permanent International Association of Road Congresses. This organization is promoting the congress, and was formed at the time of the first congress in Paris in 1908.

The congress will be held at Brussels for one week beginning July 31, and will be under the patronage of King Albert the First of Belgium. The honorary presidents are Mr. Schollaert, Ministre de l'Interieur et de l'Agriculture, President du Conseil; Mr. Delbeke, Ministre des Travaux Publics; Mr. Davignon, Ministre des Affaires Etrangeres, and Mr. Helleputte, Ministre des Chemins de fer, Postes et Telegraphes. There are also a number of committees and commissions, including Committee of Patronage, Local Organizing Commission, Technical Committee, Reception and Excursions Committee, Exhibition Committee, etc.

Mr. Samuel Hill, as the vice-president of the American Road Builders, secured recognition of that organization as the official representative of the Permanent International Association in the United States and Canada, and any memberships or papers that may be sent in the care of E. L. Powers, secretary of the American Road Builders, at 150 Nassau st., New York City, will be forwarded.

Specifications for Expansion Joints for Brick Pavements.

Please send me specification for expansion joints and joint filler where cement is used as filler in brick pavement.

O. A. WINNBERG,
Assistant City Engineer, Wausau, Wis.

The specifications prepared by the National Paving Brick Manufacturers' Association will be found in MUNICIPAL ENGINEERING, vol. xxxiii, p. 88. They provide for a joint next the curb one inch thick filled two-thirds full of pitch and the top one-third with sand. An inch board is laid along the curb before the brick are laid and within 36 hours after the cement filler is put into the joints this board must be removed and the space filled with pitch and sand.

In vol. xxxiii, p. 391, is a specification for the filler and for placing it. The filler there specified is asphaltic, having 20 parts approved refined asphalt and 3 parts of oil and 100 parts of pitch, both from coal tar, ordinarily numbered 4 at the factory. It must be at least 300 degrees F. when poured and the sand bed and brick must be free from moisture.

Prof. I. O. Baker, in vol. xxviii, p. 239, recommends coal tar No. 6. In vol. xxxi, p. 32, he describes the same coal tar filler and also the Pioneer asphalt filler, which is composed of asphalt not less than 99.5 per cent pure bitumen, composed of not less than 68.3 per cent. petrolene of specific gravity not less than 0.90, and 31.2 per cent. asphaltene of specific gravity not less than 1.13, the specific gravity of the compound being not less than 0.99. The filler is not to begin to melt below 195 degrees nor to run at less than 215 degrees, to be ductile at all ordinary temperatures and not affected by moisture. This is apparently a very detailed and strict specification.

In vol. xxxv, p. 143, coal tar paving cement No. 6 is reported in use as filler in Columbus, O. On p. 281 Mr. W. P. Blair gives details of method of placing and removing boards for providing the space for the pitch filler.

Specifications for Tar Macadam Roads.

Will you please give specifications for tar macadam roads and estimated cost per square yard, stone costing, say $1.15 per ton.

J. D. R., Mayor, ——, Va.

Several articles in the last volume (xxxvii) of MUNICIPAL ENGINEERING give such specifications. They will be found on pp. 109, 130, 143, 254 and 274, with some instructions and reports of experiments. Practice is not yet sufficiently crystallized to make standard specifications or definite estimates of cost. The cost will probably somewhat exceed $1 a square yard for a good road. The article on tests of road materials on another page of this number of MUNICIPAL ENGINEERING gives some instructions as to the construction of tar macadam roads.

Method of Assessing Cost of Street Intersections.

At the present time our city is planning the laying of about forty or fifty blocks of pavement, and I am confronted just now with the question of the manner of making assessments, and according to your invitation, I am writing you for special information concerning the practice in other cities.

The plan of our city is to pave two of the main streets running east and west and to tax the costs thereof to abutting property owners, including the cost of intersections. Now if we tax the costs of the whole intersection to the main streets running east and west, and some time in the future it is planned to pave the streets running north and south and crossing the main streets at right angles, the streets running north and south will not be called upon to pay for any part of paving the intersections on the streets already paved as the paving on those intersections will be already in. What would be your advice in forming some kind of a plan to tax the costs of the intersections to side streets which are not paved? Our statute provides for assessing the costs to abutting property.

E. J. KELLY, Perry, Iowa.

If the statute limits the assessments to abutting property only, there would be an evident injustice in assessing the cost of intersections upon the property abutting on the street only, unless indeed all the lots faced on, say north and south streets and only the sides of the lots abutted on the cross streets.

The method formerly used in Indianapolis assessed the cost of an intersection of two streets upon the property abutting on the streets in all four directions, half the assessment being spread over the property abutting on the street under improvement extending half way from the intersection to the next cross street each way. The other half of the cost of the intersection was assessed on the property abutting on the cross street, from the street under improvement half way to the next street each way. In this way each piece of property that would be interested in the intersection at any time pays its share of its cost at the time the intersection is paved.

If the general funds of the city will permit, the intersections may be paid for by general taxation. There are two principal objections to this method. One is that many cities do not have the money and paving is delayed or stopped if this is required. The other is that many property owners will be paying taxes used to pave intersections of streets far from them and many years before the intersec-

tions in which they are personally interested are paved. This objection is offset in part by the fact that the paving increases the taxable valuation of the city, especially in the paved district and thus relieves the property in unpaved sections of a share of its taxes for all purposes.

Another method of assessing cost of pavements is to divide the area extending back from the street a half block into zones, assessing a large amount per square foot on the first zone, and progressively smaller amounts on the second, third and even fourth and fifth zones. This amounts to about the same thing as the first method described in case the platting of the city is reasonably regular. If there are irregularities it sometimes levies assessments on property not abutting on either the street under improvement or the cross streets. If there is an opportunity to revise the assessments and eliminate inequities incident to the strict application of any rule, either rule will be generally satisfactory, provided some assessment for street intersections can be made legally upon property not abutting on the improved street, but which would receive an assessment for the same were the cross streets improved before or at the same time as the street under consideration.

Macadam Base for Asphalt Pavement.

I would like to know if macadam base has been used successfully under asphalt wearing surface as a substitute for cement concrete and in which manner same has been laid.

H. C. SMITH, Mexico, Mex.

Occasional experiments have been made in this sort of construction but, so far as the writer knows, with indifferent success. Sub-drainage must be perfect and the base must be compact beyond chance of unequal settlement. It must be strong enough to stand any concentration of load which may be brought upon it. These requirements are difficult to attain except at a cost approximating that of a concrete base. Some of them might be attained by using an old, thoroughly compacted macadam street as a base, except that excessive crown and difficulties with drainage are hard to meet. Will our readers report the results of their constructions of this sort if they have any?

Forming Street Surfaces with Irregular Gutters.

McCullough in his excellent work on "Engineering Work in Towns and Small Cities," on p. 334, mentions using gutter summits in cases where street grades are level or nearly so, to improve the flow of water in the gutter, but nothing is said as to methods. I find that to form the irregularity by hand seems tedious and even difficult; false work on the curb, using the same lute as for the regular crown would produce a hollow along the center. I have a couple of places I would like to use the scheme. What is the practical method of producing the irregular shape in brick paving? Our regular crown will be the parabola curve with gutter six inches deep. Your advice will be appreciated.

C. E. V., East Palestine, O.

Can our readers suggest methods of construction?

Perhaps the instrument for setting stakes and computing cuts, which is shown in the department "From Workers in the Field" on a following page would be of assistance. Stakes set by this or some other instrument should aid in getting the concrete properly surfaced. The paper on "Crowns for Pavements" elsewhere in this number will also be of assistance. A standard lute can not be used, for the form of the parabola changes from point to point as the depth of the gutter changes. Probably the depth of gutter will be varied each way from the standard of six inches. The stakes at the quarters and the measurement of ordinates from the crown recommended by Mr. Warren in the article above referred to will probably be the easiest to apply. The parabola differs so little between stakes from the straight line, when the stakes are set as recommended by Mr. Warren, that the surface of the concrete can be located near enough by the use of boards with straight edges long enough to reach between stakes both ways.

When the sand is to be luted, light strips can be laid in the sand, supported in any convenient way, mainly by the sand, and extending from crown to quarter and from quarter to gutter. A straight edge drawn over two of these will level the sand down to the form for rolling. In other words, the luting will be from crown to gutter, rather than parallel to the gutter. Careful setting of the stakes for the concrete so that they can be used in part at least for the luting of the sand will take care of the slight warping of the surface due to the change in the form of the parabola, since the lutes should be straight in the direction of the length of the street and will be used in that position.

Narrowing the Roadways in City Streets.

Kindly let me have some data as to the practicability of narrowing eighty-foot streets with forty-eight-foot driveways to thirty-two-foot driveways. We have a suburban city.

GEORGE HOLMES,
Pres. of Board of Trustees,
Coronado, Cal.

This is a subject which is discussed at some length in many of the reports that have been made recently about improving the appearance of cities. It is also considered in the books on city pavements. The general consensus of opinion is that the roadways should be narrowed to correspond with the traffic over them. The business streets and those with street railway tracks may need 40 to 48-foot driveways, and main lines of travel into the residence districts or out to main country roads, without street car tracks

need 30 to 40-foot driveways. The average residence street has no use for a paved roadway more than 24 to 30 feet wide.

The breadth of view which is claimed as one of the beauties of wide streets, is not interfered with by narrowing the roadway, while the near view of grass, flowers, shrubs and trees is much more acceptable than the bare pavement.

The narrow streets are also far more sanitary. The droppings of horses dry up on the pavement and blow about as dust into houses, vehicles and persons passing, but there are none on the grass plots. The narrow pavements are much easier and cheaper to keep clean and to keep sprinkled, if this treatment is followed, and they are farther from the houses, so that the unsanitary conditions are less pronounced as well as more easily removed.

Trees grow better on the wider grass plots and their number may perhaps be materially increased. Their shade as well as the less area of sun-reflecting hard pavement diminish the temperature, thus adding greatly to comfort.

Then the pavement of the roadway costs in proportion to its area, and a reduction of a third in width means a reduction of a third in cost.

In a city requiring irrigation this is not all clear gain, for the grass, trees, flowers and shrubs must be watered to make them grow.

The uselessness of a wide pavement, the waste of money in building it, the beauty of the area not paved, which can be obtained for the cost of maintaining the pavement, are unanswerable arguments. The writer has never seen an argument in favor of wide pavements except the two suggested above, and has never seen any one who could really convince himself that these arguments were valid when his attention was drawn to their nature.

Salt Lake City, noted for its excessively wide streets, has recently recognized the beauty, utility and economy of narrow pavements. These and the streets of numerous other cities having the same ideas are shown in the volumes of MUNICIPAL ENGINEERING.

Where Are Any Very Large Water Tanks Located?

I should appreciate it very much if you could inform me as to where there have been built in this country any very large water tanks, either of steel or any other construction. We are thinking at present about a tank about 50 feet high and 60 to 80 feet in diameter. Of course just this kind of a tank may not be built, but it would aid in our study of the matter if we could find out about some similar tanks.

A. K. H., City Engineer, ——, Okla.

Can our readers refer our correspondent to any tanks approaching the dimensions named or give him any suggestions as to what they have done on similar problems?

Rattler and Service Tests of Paving Brick.

Can you furnish me with any data showing the relation between rattler and service tests on brick paving block?

E. R. W., Columbus, O.

MUNICIPAL ENGINEERING has published all the data upon this subject, obtained from observations made for this magazine. In vol. xxii, pp. 283 and 363 will be found the fullest data on the subject, being two articles describing rattler tests and observations of wear on test brick pavements laid in Detroit.

Record Forms for Electric Pumping Plant.

Our company has just put in operation an electric pump having a capacity of 5,000 gallons per minute.

Can you give me information about a record book in which to keep account of current used, hours pumped, etc?

W. B. R., ——, Pa.

Can any of our readers supply the desired forms?

Filtering Intake for Water Supply from River.

I thank you for your reply as regards natural filters proposed to be planted in the Ohio river next year for this company. I decided to sink not less than 10 shells, each 6 feet in diameter and 5 feet deep; connecting to either 10 or 12-inch pipes and from them to the regular 18-inch suction pipe 450 feet from the pumps, extreme low water to pump discharge valves 25 feet vertically.

I aim to give ample shell filter area, large suction pipes in them, so that the velocity of the suction in the branch pipes is never lifting sand or gravel, and if they did, I have 200 lbs. per square inch to blow out and settle filled shells, though I do not think for a moment these 6-foot shells will fill with sand. The shells are to be made of ⅝-inch steel, steel heads lighter to handle, and well painted with red lead will last forever.

All the shells will be set in 2 feet of 1-inch gravel, specially filled in cofferdam, gravel to be at least 6 inches above bottom of shells, then 5 feet of coarse sand, and fo r the finish 2 feet of gravel to fill to regular surface of river bottom. The cofferdam will be excavated to a large area, at least 40x70 feet, thus giving ample filter surface for the shells. We have not found the depth of coarse sand by probing with pipes. No doubt the sand is not less than 25 feet in depth. The suction pipe with all the shell connections and shells will rest on a number of light oak piles, so no settling or springing of the flanged pipe joints can take place. All the 450 feet of 18-inch suction pipe will be cast iron, or smooth inside 5/16-inch steel pipe, in tunnel where no heavy short joints can be accommodated. The suction pipe of old strainer system now in use will be left in place, branched to the new suction pipe, operated by 2 18-inch gate valves which are in a laying position to avoid air pockets. The 18-inch valves to be operated from a tower near pump house (110 feet). This is now the plan for the 2-million system, and I expect to get full supply of 2 million from 10 wells, and if necessary can put more shells at end of suction, should there be a shortage.

Is there anything here that is not feasible or practicable? The only thing I alway was afraid of was the 25-foot suction lift and 450 feet of a pull to pumps, but

in this extreme low water I can run old strainer system temporarily until the river rises.

By the way, the excavation of cofferdam will be 12 feet. I will want to rent 16-foot sheet piles, 220 feet lineal. I also may need a lot of short sheet piles about 10 feet long.

A. S., ——, Ky.

Suggestions from our readers will be printed if sent to the editor.

There seems to be a patent on a method of getting water from a river bed quite similar in its general features to the plan described, which is in use in a West Virginia town on the Ohio river.

Information about the sheet piling will also be welcome.

Books on Dry Closets and Country House Sanitation.

We wish to know what books there are on dry closets and sanitary country houses.

G. & M., Fargo, N. D.

Gerhard's "Sanitation, Water Supply and Sewage Disposal of Country Houses" ($2), and Bashore's "Sanitation of a Country House" ($1) are books on the latter subject. The best treatment of the dry closet in an American book is found in a chapter of Chapin's "Municipal Sanitation in the United States" ($5).

Books on Landscape Gardening—Card Index for Engineer's Office.

Can you refer me to any source where I may procure text-books on landscape gardening or landscape architecture? Have you any references pertaining to forms for card index for an engineers office?

J. C. C., Watertown, S. D.

The following are the books on landscape gardening, of which there have been several new ones recently published:

Repton's "The Art of Landscape Gardening" ($3.22) a new edition edited by John Nolen of two old English books.

Parson's "Landscape Gardening" ($2).

Maynard's "Landscape Gardening" ($1.50).

Lowell's "American Gardens" ($7.50).

Kellaway's "How to Lay Out Suburban Home Grounds" ($2).

Ferree's "American Estates and Gardens" ($10).

There have been some good articles on methods of indexing engineer's records in MUNICIPAL ENGINEERING, in vol. xxxviii, p. 56; vol. xxx, p. 409; vol. viii, p. 236.

Another good article will be found in the *Journal of the Association of Engineering Societies*, vol. xliii, p. 111, and one on the filing system in Salt Lake City, in vol. xliv, p. 72.

Who Sells Natural Red Chalk?

Who deals in, and where can I get "Red Chalk" (Ruddle) in its natural form in bulk, just as produced from the earth? Where is the best natural product found, for marking engineers' stakes? Can you give names of some dealers in this kind of chalk? I have tried some from a St. Louis firm, but the stuff was altogether too hard to use on wood, and rather too light in color. L. C. H., Bellingham, Wash.

Can our readers give any information about the natural product?

Carrying Capacity of Cement Floor.

I would like to know the carrying capacity of a cement floor 8 inches thick. Mixture: 1 cement, 2 sand, 3 stone. The floor to be built on a well-packed cinder bed. H. F. S., Napoleon, O.

If the load is distributed over the whole area of the floor, the load will be limited by the carrying capacity of the earth under it. This can be determined approximately by the principles upon which the breadth of foundations are computed with a knowledge of the character of the material upon which the foundation rests.

Should the loads be concentrated, the crushing strength of the concrete as determined by tests of cubes will certainly be safe if applied to the larger and far better supported volume of the concrete floor. Various mixtures run from, say 800 to 4,000 or more pounds per square inch. Unless the sub-foundation is insufficient, as determined by the same method suggested above, using the area on which the load is concentrated plus an area about 8 inches wide all round outside the area covered by the load. Safe loads on various earths are, say 2 tons per square foot for clay and sand and one-half ton for soils, with increase of 100 to 200 per cent. under specially favorable circumstances. Gravel and coarse sand, well cemented and confined, will carry 8 to 10 tons per square foot.

The cinder bed would not be as strong as the compact gravel foundation. Say one ton per square foot would probably be safe for any probable foundation, with material increase for more favorable foundations.

Canadian Cement Merger.

We have been given to understand that the Canada Cement Company, Ltd., with offices in Montreal, P. Q., has taken over a large number of the cement mills in Canada, and these have all been united under one management, with the foregoing name. This is not brought out in your fifth edition of your "Directory of American Cement Industries." We would very much appreciate your sending us, if you have the data at hand, this desired information.

P. B. G., Rochester, N. Y.

The combinations of Canadian cement companies have been made since the fifth edition of the "Directory of American Cement Industries" ($5) was issued. The Canada Cement Co., Ltd., Montreal, Que., has been formed to take over the following companies:

Alberta Portland Cement Co., Calgary, Alberta.

Belleville Portland Cement Co., Belleville, Ont.

Canadian Portland Cement Co., Toronto, Marlbank and Port Colborne, Ont.

International Portland Cement Co., Ottawa, Ont., and Hull, Que.

Lakefield Portland Cement Co., Montreal, Que., and Lakefield, Ont.

Lehigh Portland Cement Co., Belleville, Ont.

Owen Sound Portland Cement Co., Owen Sound and Shallow Lake, Ont.

Vulcan Portland Cement Co., Montreal and Longue Point, Que.

It is proposed to acquire also the Western Canada Cement and Coal Co., Exshaw, Alberta, and the Eastern Canada Portland Cement Co., of Quebec, not yet established.

The following directors of the new company are officials in one or more, some of them in as many as three, of the above named companies: Sir Sanford Fleming, J. M. Kilbourn, J. S. Irvin, W. D. Matthews, Robert W. Kelly, William R. Warren, W. H. E. Bravender, E. M. Young.

Other directors are: J. R. Booth, Geo. E. Drummond, W. C. Edwards, Robert Mackay, G. A. Cox, W. M. Aitken, C. H. Cahan.

Another cement combination is reported to be in process of formation by J. R. Roaf of Toronto, Ont., to be known as the Independent Portland Cement Co. The following companies are reported to have agreed to enter the combination:

Bells' Lake Cement Co., Markdale, Ont., proposed plant.

Brant Portland Cement Co., Brantford, Ont., proposed plant.

Colonial Portland Cement Co., Wiarton, whose affairs are being wound up by the courts.

Hanover Portland Cement Co., Hanover, Ont.

Imperial Cement Co., Owen Sound, Ont.

Ontario Portland Cement Co., Brantford and Blue Lake, Ont.

St. Marys Portland Cement Co., St. Marys, Ont., proposed plant.

Superior Portland Cement Co., Orangeville, Ont.

Western Ontario Portland Cement Co., now known as the Maple Leaf Portland Cement Co., Atwood, Ont.

This leaves the following companies independent:

Edmonton Cement Co., organization under consideration.

Rocky Mountains Cement Co., Calgary, Alberta, under construction at Blairmore.

Vancouver Portland Cement Co., Vancouver and Tod Inlet, in operation.

Commercial Cement Co., Ltd., Winnipeg and Babcock, Manitoba, in operation.

Portland Cement Co., Winnipeg and Conor, Manitoba, proposed plant.

Sydney Cement Co., Sydney, Nova Scotia, puzzolan plant in operation.

Ben Allan Portland Cement Co., proposed plant near Owen Sound, Ont.

National Portland Cement Co., Durham, Ont., in operation.

Nova Scotia Cement and Plaster Co., Toronto, incorporated.

Sun Portland Cement Co., Owen Sound, Ont., in operation.

Toronto Lime Co., Limehouse, Ont., natural cement.

Isaac Usher, Queenstown, Ont., natural cement.

There is also the Portland Cement Company of Canada, Quebec, Que., which seems to be a sales agency.

The Concrete Industry in the West.

Will you please send me information you may have of the cement industry in Oregon and Washington? I have been thinking of locating in the west, and if you can tell me anything about this line I will be obliged to you. I am a contractor at this place, doing general concrete work of all description. Can you tell me the general price paid for cement per bbl., also other materials and the prices paid to the contractors for the work in that section of the country? I am a subscriber of your "Directory of American Cement Industries."

C. L. S., ——, Pa.

Will our readers send us some special information for the benefit of our correspondent?

There are numerous brands of cement made on the West Coast and many other imported and eastern cements are in use there. Full information about them will be found in the "Directory of American Cement Industries" ($5). Reference should be made to the "Geographical List of Cement Manufacturers" under the states of California, Colorado, Idaho, Montana, Oregon, Utah and Washington for names of present and proposed cement plants. Cements from Kansas and Pennsylvania will be found on the market also, and foreign cements from Belgium, England, Germany, Canada and Japan, as well as such special products as white Portland cement and bricklayers' cement from the central states. Local Seattle market reports show steady quotations of $2.20 a barrel for West Coast cements, sacks extra; $2.70 for Eastern cements, sacks extra; $2.75 for foreign cements, and $2 for bricklayers' cement. Lime is quoted at $1.60 to $1.65 a barrel according to quality; common brick, $9.50 a thousand; paving brick, $20; common dimension lumber and shiplap, $14 per M.; reinforcing bars, 2¾ to 3½ cents a pound; pig iron, American, $22.50, English, $25 to $26 a ton; crushed marble and granite, $20 a ton; gravel and sand, 80 cents a cubic yard.

Recent paving bids in Seattle ran from 30 to 60 cents a cubic yard for sub-grading; $1.43 to $1.70 a linear foot for straight granite curb; 31½ to 35 cents a linear foot for concrete curb; 55 to 75 cents a linear foot for armored curved concrete curb; $1.50 to $1.70 a square yard for asphalt paving on concrete base; $3.50 to $3.90 for sandstone block paving; $1.20 to $1.50 for concrete alley crossing; $1 to $1.20 a square yard for concrete sidewalk; $7 to $8 a cubic yard for concrete wall.

In other cities concrete paving costs $1.50 to $2.83 a square yard, according to quality; asphalt, $1.50 to $1.85; brick, $2.80; bitulithic, $2 a square yard; cement sidewalk, 15½ cents a square foot; building macadam road, $1.74½ a cubic yard.

Seattle sewer bids run $2.50 to $3.15 a linear foot for 15-inch pipe; $4 to $5.40 for 24-inch pipe; $6.25 to $11.75 for 36-inch brick sewer; $10.55 to $13.15 for 48-inch reinforced concrete sewer; $11.70 to $13 for 54-inch; $12 to $18 for 60-inch, according to difference in specifications; $20 to $24.25 for 72-inch reinforced concrete sewer; extra concrete, $8 to $12 a cubic yard; extra steel, 5 to 6 cents a pound.

On a water works reservoir in Portland, Ore., prices on two contracts varied for earth excavation from 24 to 66⅔ cents a cubic yard; concrete, $7.80 to $12.75 for Class A and B and $6.65 to $12 a cubic yard for Class C; concrete walk, $1 to $1.50 a square yard; steel reinforcement, 3½ to 6 cents a pound.

FROM WORKERS IN THE FIELD

Practical Points from Practical People.

Contributions to this Department are invited. Give from your experience for the benefit of others. No matter about the style of the composition, the fact is what is wanted. Use the Question Department for what you want to know; use this Department for what you can tell others.

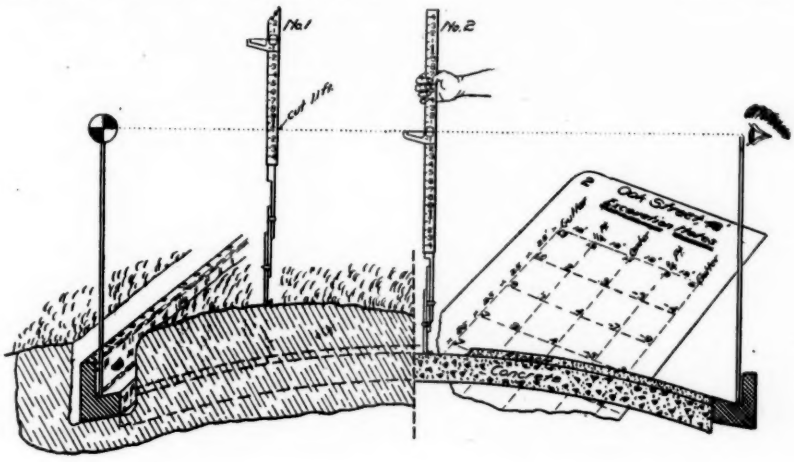
Crowning Instrument and Excavation Calculator.

To the Editor of MUNICIPAL ENGINEERING:

Sir—The accompanying cut shows a crowning instrument and excavation calculator, invented by me. The instrument of the common type will construct any crown of pavement from 0 to 14 inches, and will calculate any depth of cut or fill from 0 to 18 inches. These may be increased by special construction.

In using the instrument the curb and gutter, or curb, is first constructed, which is usually contracted including excavation. Then targets are set up in the gutters, the eye sighting over one to the other. Position No. 2 shows the operator giving grade for concrete at crown or center of pavement. Position No. 1 shows the amount of cut at the ¼ point, the eye reading 1.1 ft. direct without any figuring. The left half of the picture is a section of the isometrical view of a street with curb and gutter constructed. The right half shows a cross-section of the pavement with a leaf from the note book showing the simplicity of excavation notes, the positive numerals indicating cut and the minus numerals fill. The instrument can be used on the most complex crowns as readily as on the simple ones. O. E. NOBLE, City Engineer,

Hobart, Okla.



Report of the Indianapolis Municipal Asphalt Repair Plant for 1909.

To the Editor of MUNICIPAL ENGINEERING:

Sir—During the year 1909, from January 1 to December 31 inclusive, there were turned out by the Indianapolis municipal asphalt plant 14,344 boxes surface mixture, 416 boxes cushion and 327 boxes binder, a total of 15,087 boxes of mixture turned out in this period.

There was expended for automobile, brick testing machine and extra sheds, $939.01.

The repairs covered more than sixty different streets, and some of the streets have been almost resurfaced, as in the case of West New York street, from Blake to West, and Kentucky avenue from West to Oliver avenue, on both of which there has been a heavy hauling of gravel and which was almost impossible to keep in repair before installation of this plant. On several other streets the repairs were extensive, but by our method of joining on to our former patches, the streets will eventually be re-surfaced, and the old-water-soaked and lifeless material will be replaced with first-class material.

There were 1,300.14 sq. yds. of concrete laid by this department on the private work done for plumbers and public service corporations.

There were also done by this department the necessary grading and 2,061 sq. yds. 4-inch Portland cement concrete, and 2,061 sq. yds. of brick paving, also 972 sq. yds. 4-inch concrete, 972 sq. yds. 1-inch binder and 972 sq. yds. 1½-inch asphalt surface on the driveways of the City Hospital; as well as 705 lin. ft. circular curb (cement), 472 lin. ft. straight curb (cement), 9,873 sq. ft. of cement walks and courts, 120 ft. of sewer connections for catchbasins, three catchbasins and a cement garbage platform 8 ft. x 14 ft. x 4 ft. 4 in. high. This hospital work was from a special appropriation for the work and cost $8,434.81.

On January 1, 1910, there was on hand and paid for sand, asphalt, coal, limestone dust, fluxing oil and other materials costing $793.63.

The total amount of private work last season amounted to 8,743.87 sq. yds., and the money paid or due the city controller for this work amounts to $16,371.40, for which amount our fund should be credited.

There was appropriated for the street repairs, asphalt plant and maintenance fund during the year $63,000, added to which the material on hand January 1, 1909, $2,321.88, gave a total amount of $65,321.88 available during the year. There was a balance unused of this fund of $18.88.

The total cost of all work done exclusive of the hospital work, which was separate, was $65,720.02 for 79,003 sq. yds., or 83 cents per square yard. This includes interest on investment of $21,469.69 for the year at 5 per cent and depreciation at the same rate, also the cost of concrete necessary on private work.

Deducting $16,371.40 money received or due for private work, also cost of concrete work on private work $1,300.14, would leave the actual cost of the city's own repairs to be $48,048.48 for 70,259.5 sq. yds., or 68 cents per square yard. This includes all expense attached to work, superintendence, interest on total investment, depreciation on plant, rollers and tools, and insurance, lease on grounds, also extra cost of binder or cushion where needed to bring foundation up to within 2 inches of the street.

The work was extended over the whole year, so as not to allow the holes to become too large, and was done on the eight-hour basis, same as other city work, and the season was what would be called by the contractors a wet paving season.

Maltha California asphalt at $23.80 per ton was used, with either petroleum residuum or Indian river asphaltic base oil as a fluxing agent, and the best of labor and material used throughout, thus insuring first-class work.

Altogether there was turned out by this plant 14,344 boxes of surface, 416 boxes cushion and 327 boxes of binder, a total of 15,187 boxes of mixture, and no delays of any kind were occasioned by the plant.

	Asphalt Surface.
Actual city repairs	70,259.50 sq. yds.
Private	8,743.87 sq. yds.
	79,003.37 sq. yds.
Hospital driveways	972.00 sq. yds.
	79,975.37 sq. yds.

Also 200 sq. yds. binder, making a total of 80,175.27 sq. yds. of surface and binder turned out by this plant and laid during this year, also 1,300.14 sq. yds. concrete.

Automobile, extra sheds, brick rattler	$939.01
Concrete	1,300.14
Private work	16,371.40
Material on hand Jan. 1, 1910	793.63
Balance fund on hand	18.88
City's own repairs (cost)	48,048.48
	$67,471.54
Fund appropriated	$63,000.00
Interest and depreciation for 12 months @ 10 per cent	2,149.66
Material on hand Jan. 1, 1909	2,321.88
	$67,471.54

SAM R. MURRAY,
Superintendent of Asphalt Plant,
Indianapolis, Ind.

Pavements for Hot, Dry Climate.

To the Editor of MUNICIPAL ENGINEERING:

Sir—We notice in your December issue, page 395, an inquiry from Phoenix, Arizona, under the heading "Pavements for Hot, Dry Climate," signed "T. J. P., Phoenix, Arizona." In reply you stated "Bitulithic pavement has been used in the South, but perhaps is not as hot and dry a climate as Phoenix." Large areas of Bitu-

lithic pavement have been laid throughout the South, particularly in Texas, and the City of El Paso alone has been using bitulithic pavement for the last four years and now has 270,000 square yards in use. El Paso has an extremely hot and dry climate with practically no shade.

GEO. C. WARREN,
President of Warren Brothers Company,
Boston, Mass.

MUNICIPAL MATTERS IN COURT

Higher Courts——Memphis Charter—New Jersey Water—Sewer Decisions

Decisions of the Higher Courts of Interest to Municipalities.

PREPARED BY JOSEPH W. KENNEY, ATTORNEY AT LAW, INDIANAPOLIS, IND.

Vacation of One Side of Street—City's Liability to Property Owners on Other Side.—Where a street was laid out on a city plan, on both sides of a railroad, but not across the right of way, there being a mere permissive crossing, the vacation of a portion of the street on one side of the railroad did not render the city liable for damages to owners of property abutting on the street on the other side, especially in the absence of proof that the crossing on the vacated side joined any well-defined road corresponding at any time with the platted lines of the street on that side.—Siddal v. City of Philadelphia, 73 A. 1013, 225 Pa. 55.

Water Area Included Within City Boundaries.—It was not error to hold that the water area within the boundaries of a proposed village should be included as a part of the one-half square mile, which by St. 1898, Sec. 854, a village proposed to be incorporated must cover, and such ruling was not tantamount to a holding that no village should be incorporated which bordered on a large body of water, for the incorporators were not obliged to include the water area, and, furthermore, there is no limitation placed upon the area of a village by statute further than to prevent the entire town or towns being included.—Fenton v. Ryan (Wis.), 122 N. W. 726.

Dismissal of City Officer by Mayor—Limitations of Power.—Laws 1885, p. 1251, c. 378, establishing a fire and police commission, vested in the commission the appointment and removal of the chiefs of the fire and police departments, but section 11 provided that the chief of police and the chief of the fire department etc., should be subject to suspension from office for cause by the mayor at any time pending charges by the commission. *Held*, That the power of suspension was discretionary in a high degree, permitting the mayor to look not only to the charges, but to the necessities of the community, and his decision not to exercise the power in a given case was not subject to review or direction by the courts where there was not an entire refusal to consider and exercise discretion.—State v. Rose (Wis.), 122 N. W. 751.

Council Member's Agreement to Secure Contract with City—Grounds for Expulsion—Right to be Heard in Defense.—A city council member, who agreed for a consideration to aid in securing a valuable contract with the city and to secure an increase in the appropriation to unduly increase the profits, was guilty both of disorderly behavior and malconduct (misconduct) in office within Gen. St. 1906, Sec. 1012, authorizing an expulsion therefor * * * * such council member, or any officer of a city should be given an opportunity to be heard in defense of any charge against him for which he may be expelled.—Etzler v. Brown (Fla.), 50 So. 416.

Street Improvement Assessment Does Not Extend to County Courthouse Square.—Under a system of county and municipal government, statutory authority given a city to impose a street improvement assessment will be held not to extend to a county courthouse square, unless an intent to include such property clearly appears.—Edwards v. City of Ocala (Fla.), 50 So. 421.

City Liable in Private Capacity for Negligence in Operation of Municipal Water Works Plant.—Where a city maintained water works for public and private use under the control of a board of commissioners, who employed a superintendent and such a agents and servants as were required, the revenue being applied to the cost of construction, operation and maintenance, the city in so doing acted in a private and not in a gov-

ernmental capacity, and was therefore liable for injuries to a citizen by the negligence of its servants in charge of the water works resulting in the flooding of his premises.—Piper v. City of Madison (Wis.), 122 N. W. 730.

Compensation of City Attorney—Recovery in Excess of Salary Must be Based upon Special Employment.—Under a village ordinance, fixing at a specified amount the annual compensation of the village attorney, and providing that in certain cases such attorney shall be allowed the usual fees of "attorneys practicing in such courts" besides the amount fixed as his salary, the attorney can not recover for his services during the year of his appointment a sum in excess of the amount so fixed, in the absence of any record showing a special employment by the village board in one or more of the cases mentioned.—McGorney v. Village of Melrose Park, 89 N. E. 264, 241 Ill. 142.

Amendment of Ordinance to Conform to Statute.—An ordinance of a city of the second class imposing a penalty of $200 for carrying on the business of a pawnbroker without a license may be amended so as to reduce the penalty to $100, and thus make it conform to Act March 7, 1901 (P. L. 20), granting cities of its class the power to enforce all ordinances by inflicting penalties for violation not to exceed $100 for any offense.—City of Scranton v. Engel, 39 Pa. Super. Ct. 534.

Improvement of Streets Abutting on County Property.—The statutes do not authorize a city to improve the streets abutting on county property at the expense of the county, in the absence of a contract on its part to pay therefor.—Edwards v. City of Ocala (Fla.), 50 So. 421.

Improvement of County Property.—The authority to improve county property is by statute given the county commissioners alone and can not be directly or indirectly exercised by a city.—Id.

Predetermination of Cost of Improvement—Change in Specifications—Paid for as Extra Work.—Where the nature of a public improvement permits a predetermination of its actual cost, it should be determined by the city council, but a provision in sewer specifications that if, in the judgment of the city engineer it shall be necessary to form any part of the foundation of the sewer of concrete, it shall be paid for as extra work, was not void as giving the city engineer discretionary power to vary the cost of the work.—McCaleb v. Dreyfus (Col.), 103 P. 924.

Conditional Signature Invalidates Petition for Improvement.—Where a property owner wrote the word "conditionally," after his signature to a petition for the paving of a portion of a street, without specifying what the condition was, the property could not be counted in determining whether the petition was signed by the owners of the requisite two-thirds of the frontage; any condition invalidating such a signature.—Newton v. Borough of Emporium, 73 A. 984, 225 Pa. 17.

Partial Vacation of Street—Abutting Owner Entitled to Special Damages—Injunction.—An owner of lots abutting a portion of a street narrowed and partially vacated as the result of a proposed replot suffered special damages different in kind from that suffered by the community at large, and was therefore entitled to sue for an injunction restraining such vacation.—Brazell v. City of Seattle (Wash.), 104 P. 155.

Tax Levy to Maintain Municipal Water Plant Objected to by Private Water Works Company as a Discrimination.—A village applied to the State Water Supply Commission for approval of plans for municipal water works, stating therein that the village would purchase at a fair price the existing water works system of defendant company. The application was granted, but the proposition to purchase defendant's plant was lost on submission to the voters. A part of the village tax was levied to maintain the municipal water works system, and defendant objected to the levy of any part thereof against its property in the village, claiming that such tax would discriminate in favor of the municipal water plant. *Held,* That as the village had jurisdiction of the defendant's property the tax was not void.—In re Beauty Spring Water Co. 118 N. Y. S. 659.

Questions of Bond Issues for Water Works and Sewerage Must be Separately Submitted to Voters.—Under the statutes authorizing the issuance of municipal bonds on the voters voting therefor, water works and sewerage are distinct propositions, and must be separately submitted to the voters, and there is no legal authority for the issuance of bonds to enlarge a water works system and add a system of sewerage submitted to the voters as one proposition.—Chase v. Gilbert (S. C.), 65 S. E. 735.

Constitutionality of Memphis Charter Attacked.

In a suit filed January 1 by several citizens of Memphis, Tenn., the constitutionality of the new charter of that city, creating a commission form of government, which became operative at midnight December 31, was attacked. The suit was filed in the chancery court against Mayor E. H. Crump and the four commissioners, alleging that the new charter takes away the right of self-government and gives to the commissioners despotic powers.

Contest Over New Jersey City Water Supply.

Arguments were heard by Vice-Chancellor Stevens, January 18, on the return of a rule to show cause in the proceedings brought by Newark, the East Jersey Water Company and the Jersey Water Supply Company on three separate bills,

to enjoin suits at law brought by the Chestnut Hill Land Company to recover damages for the diversion of water from the Passaic river. The bills of the complainants allege that the damage done to the defendant land company, if any, is chiefly, if not entirely, caused by the discharge of sewage into the river by Paterson. The bills further allege that the Passaic Water Company diverts water for the use of Paterson under legislative authority; that the Acquackanonk Water Company diverts water for the city of Passaic by legislative authority and prescriptive right, while the Montclair Water Company, the Jersey City Water Supply Company and the East Jersey Water Company divert water for the imperative uses of municipalities and under legislative authority.

Decisions in Sewer Cases.

At Bloomington, Ind., Judge Wilson rendered a decision Jan. 21 dissolving the temporary injunction in the sewer assessment cases in this city. This means that the original assessments of the city council will stand, and that the city treasurer may sell the property at public sale on which the tax is delinquent.

In an opinion submitted by Attorney-General O'Malley, at Albany, N. Y., Jan. 20, the rights of the state commissioner of health to prohibit the discharge of sewage into any waters of the state are defined. The attorney-general points out that the statute specifically provides that suits to restrain violations of this law, or for penalties prescribed, are to be brought by the local board of health. He also holds that the law applies to Greater New York the same as to all other cities and villages whose sewers drain into state waters.

Indiana Road Laws are Valid.

The Indiana Supreme Court has reversed its decisions with reference to the constitutionality of the gravel road and the "three mile road" laws passed by the legislature. The questions were concerning the construction of laws in which mistakes in wording had occurred, and further consideration caused the court to modify the decision made a few weeks ago and declare the laws valid. Millions of dollars of bonds issued for work completed and under construction and of work in prospect, jeopardized by the former decision, have been made safe.

CURRENT INFORMATION

Park Funds—Everett Salaries—Niagara National Park—City Plan Commission—Municipal Light for Bloomfield—Fire Alarm Transmission—Inspection of Work by Commercial Association—Pavement Assessments

St. Louis Civic League on Park Funds.

The Civic League of St. Louis, Mo., has decided that the system of establishing parks in that city is radically wrong, and the members will endeavor to have it changed with the charter. Under the present system parks are paid for and maintained out of the general fund. All residents of the city have to pay a portion of the cost, whether the parks are adjacent to their property, or whether they will ever derive any use from them.

The Civic League will try to change this, and will advocate a special assessment plan or a bond issue. A park commission of five men will be recommended, and will have charge of all parks, boulevards, public playgrounds, athletic fields, museums, baths, etc.

The league's committee report, which embodies the revolutionary recommendations, was adopted by the executive board of the league.

Contest Over Everett's Official Salaries.

As a rebuke to Mayor C. A. Bruce, of Everett, Mass., who vetoed an order placing the members of both branches of the municipal government on salary, the board of aldermen of that city voted, December 29, to abolish the mayor's salary. In vetoing this order, Mayor Bruce stated that the city was too poor to grant the salaries. The aldermen retaliated by saying that if the mayor's contention is true, the city is also too poor to allow the mayor an annual salary of $1200. Mayor Bruce claims that the action of the aldermen can not be sustained.

Houston, Tex., Proposes Assessment of Abutting Property for Pavements.

Petitions are being circulated at Houston, Texas, requesting the city commissioners to call an election to determine whether the plan of assessing abutting property owners for permanent street pavements, as provided for by an act of the last legislature, shall be adopted. The plan proposed in the petition is to assess two-thirds of the cost of pavements against abutting property owners and one-third against the city. The city officials approve of the proposition, and, it is stated, the plan has met with the approval

of citizens in cities where it has been adopted.

National Park for Niagara.

The committee of landscape architects recommends, in its report to congress, the creation of a national park at Niagara Falls. The committee urges that a strip of property be acquired by the United States connecting with the state reservation of the gorge, embracing the Talus, the Cliff and a tract of land not less than 100 yards wide, to be converted into a national reservation.

City Plan Commission Proposed for Newark, N. J.

In his third annual message to the common council, January 7, Mayor Jacob Haussling, of Newark, N. J., embodied a suggestion for the creation of a city planning commission, whose functions would be similar in nature to certain of those now vested in the board of works. In fact, the establishment if such a commission would result in relieving the board of works from some of its duties. He also urged conservatism in proposed policies involving bond issues, so far as the progressive spirit will permit.

Municipal Light Proposed for Bloomfield, N. J.

The purchase of the electric light and power equipment of the Public Service Corporation now supplying the town of Bloomfield, N. J., and use of it to convey current obtained from some municipal plant, if possible, is recommended by Mayor Sutphen, in his annual message to the town council. The town has the option, under the terms of the fifteen-year franchise granted the lighting company and which expires next year, of buying the plant. The five-year contract to light the town ends almost simultaneously with the franchise, and it is because of this fact that the mayor suggests the establishment of an illuminating department.

Transmission of Fire Alarms in Rochester.

In his annual report, submitted January 7, Charles Little, chief of the fire department of Rochester, N. Y., showed that during 1909 1,063 fire alarms were sent to the department from various sources. Of this number nearly half, or 515 alarms, were transmitted over the Gamewell fire alarm system, and 28 alarms were sent over the Standard system. The telephone played a prominent part in the delivery of fire alarms, as 432 calls for apparatus were turned into headquarters, and in addition there were 88 verbal calls to the firemen in the various fire houses.

Inspection of Public Works by Commercial Association.

The Merchants' Association of San Francisco, Cal., established a bureau of inspection, taking over on November 1 the work heretofore performed by a committee of the civic league. It is in charge of Henry A. Campbell as engineer, with D. A. Hagens as financial secretary and auditor, and seven or more office and field assistants. It is largely supported by popular subscription. The first report, for the month of November, 1909, has been printed and demonstrates the value of the service by its story of errors corrected and abuses exposed.

New Jersey to Prevent Exportation of Water from State.

In its third annual report the New Jersey Water Supply Commission asks the Governor to recommend to the legislature the passage of acts which will effectually prevent the transmission out of the state of sub-surface or underground waters, and to place them under the jurisdiction of the commission to the end that these resources of the state may be conserved for the use of the cities of the state.

MUNICIPAL AND TECHNICAL LITERATURE

Oakland Street Plans Are Modern—Rochester Asphalt Repairs—Municipal Reports

Oakland Street Plans Are Modern.

The Oakland, Cal., street department, under the supervision of Street Superintendent Walter C. Howe, has completed one of the busiest and most satisfactory years in the history of the municipality.

Early in July, 1909, at the request of the street superintendent, the board of works reorganized the street department, in so far as the employment of labor was concerned. An ordinance was passed by the council limiting the number of street laborers and other employes and providing for their continuous employment throughout the year. Under the new system, the street department is able to give continuous service and in consequence the amount of work accomplished is greater

and the efficiency of the department much enhanced.

The inspection of new construction work on paved streets, sewers and culverts as now carried on by the Oakland Street Department is very creditable. The desire of the Board of Works and the street superintendent has been to appoint only competent and efficient men upon this most important feature of public work. In consequence, the department has quietly gathered together a corps of both practical and technically trained men, whose duties are to see that the specifications covering the work upon which they are detailed are carried out to the letter. This condition has given an added stimulus to paving work throughout the city.

Many property owners are by nature skeptical of the integrity of all public work, no matter how good the reputation of the contracting firm doing the work. Assured, however, of honest and capable inspection of the materials and workmanship upon the job the results are a source of satisfaction to the property owners, the contractor and the city.

The Street Department has recently established at the city corporation yard a testing laboratory. A standard rattler has been installed, by means of which the rock placed upon any street in the city may be first tested for loss by impact and abrasion and its relative value as a paving material determined. Vitrified brick and blocks laid by the Traction Company, steam railroads or by the city are also subjected to the rattler test.

All cement used upon concrete sewers, street paving foundations, culverts and similar work is first subjected to test at the laboratory and records of such tests are filed for reference.

The laboratory is equipped with a Dow penetration machine and other equipment for making tests of asphaltic cement used in the standard asphalt paving mixtures. Other necessary tests essential to good work are made.

The laboratory is a source of much satisfaction to the Street Department, as it gives opportunity for the study of different classes of paving mixtures and paving materials; a knowledge of just what is going into the work and the chance to determine the actual value of these materials when subjected to different kinds of traffic. The data taken at the laboratory will be of incalculable value to future street superintendents.

On January 13, 1909, the Board of Works, upon recommendation of Superintendent of Streets Howe, adopted a map outlining an area within the heart of the city to be hereafter paved only with permanent pavements, i. e. standard asphalt, vitrified brick, basalt block, bituminous rock, asphalt macadam, etc. The action of the board was ratified by the City Council and in consequence the old macadam streets, with their intolerable dust in summer and mud and slush in winter, will in a few years be a thing of the past in the district lying between Market and Fulton streets, Water street and Twenty-second street. This has been one of the most important moves made by the administration in many years, in an effort toward a modern and properly paved municipality.

While it is the future policy of the city engineer and the Street Department to recommend plain macadam upon streets where property values are low and where the section is sparsely settled, these departments intend to substitute oiled macadam for plain macadam wherever possible. The cost of the oiled macadam is approximately from 3c to 5c higher per square foot, but it makes a far more satisfactory street and if the road material is properly laid and impregnated with a heavy road oil, having an asphaltum base of from 70 per cent to 80 per cent, the finished street is more elegant to the eye, is free from dust and a money saver on water and labor for sprinkling.

Wooden curbing is to give way to plain concrete, reinforced concrete or granite curbing in future street work, except in special cases, as in filled ground or upon streets and roads in the newly annexed districts, where habitation is scarce and values of property low.

An ordinance has been recommended to the City Council in accordance with the above. This means that throughout the residential districts of Oakland, concrete curbs and gutters will soon replace unsightly (and in many instances) dry rotted and broken wooden curbs.

The first vitrified brick ever laid in Oakland now adorn the Oakland Traction Company's rails on Piedmont avenue. These brick were brought from Los Angeles for the purpose. An ordinance has recently been approved and adopted by the Council at the suggestion of Mayor Mott and the street superintendent, compelling all street railways and steam roads to tooth their rails with basalt blocks, vitrified brick or special blocks. These are to be laid on concrete, which concrete must extend to the depth of each tie. Rigidity is thus obtained and the blocks remain in place. The effect of this toothing is to give a more finished appearance to the street and to obviate the now almost continual state of disintegration of pavements alongside of car tracks. The concrete between ties will give a solid foundation for the pavement to be installed and overcome the tendency of the finished pavement to settle in the space between the ties, due very often to lack of foundation.

Rochester Asphalt Repairs.

During 1909 the city of Rochester, N. Y., expended $47,278 for repairs to asphalt

pavements on which the guarantee limits had expired. The amount of pavement repaired aggregated 37,703 square yards and cost $1.23 a square yard.

Municipal Reports.

Annual Reports of the City Engineer of Minneapolis, Minn., 1907, 1908. Andrew Rinker, City Engineer.

The two reports for the two years come in the same envelope and are prepared on the same plan so that comparisons are easy. The two historical sketches are evidently prepared by different persons without comparison of results, for they give different incidents in great measure and differ in details and in dates where the same occurrences happen to be mentioned. The contemporary history given in the figures of the report is more closely in agreement.

The total expenditures in each of the two years are practically the same, the $1,717,433, of 1908 being only $137,000 more than 1907. The inventory of permanent public improvements made under the city engineers' department now amounts to $20,646,101, of which over 5 million was spent for pavements, over 6 million for sewers, over 6 million for water works and 2¾ millions for bridges. The municipal subway is put down at $14,000 and the crematory at $25,812.

Records are kept of traffic on the test wooden block pavement on Nicollet Ave. Observations were made on 19 days in 1907, three with snow on the ground, and on 12 days in 1907, two with snow on the ground. The traffic is classified as light and loaded, 1, 2 and 4 horse, rubber and steel tires and number of vehicles and tonnage is given. The number and tonnage of horses, bicycles and automobiles is also given, and a supplementary item gives the number of teams trotting and the number walking. The average tonnage, assuming traffic to be all on 25 feet of the width of the street, was 254 in 1907 and 268 in 1908.

One diagram shows the variation in popularity of the various paving materials. Beginning in 1881 cedar block of the old round form increased rapidly in mileage to 81 miles in 1894, and, with a sharp turn has diminished almost as rapidly to 9 miles in 1908. Granite, beginning in 1881 increased to 7½ miles in 1887, to 10 miles in 1893 to 1903 and to 18 miles in 1908. Asphalt, beginning in 1887, increased gradually to 5 miles in 1895, to 11 miles in 1896 and 13 miles in 1902 and decreased to 10 miles in 1908. Macadam, beginning in 1894 increased to 4½ miles in 1895, to 5 miles in 1900 and 14 miles in 1908. Brick, beginning in 1894 has increased each year with reasonable uniformity to 22¾ miles in 1908. Sandstone, beginning in 1897, has increased similarly to 20 miles in 1908. Cresoted wood block, beginning in 1901 has increased in an increasing ratio to 31 miles in 1908.

The range of prices of paving in 1908, all work being done by the city by day's labor, is for brick paving from $1.33 to $2.53 a square yard; for cresoted block paving from $2.16 to $2.87 a square yard; for granite block from 55 cents in an alley to $2.61 a square yard; for sandstone block from $2.15 to $2.66 a square yard; for macadam from $1.13 to $1.24 a square yard.

ORGANIZATIONS AND INDIVIDUALS

Illinois and Indiana Water Supply Associations—National Association of Cement Users—Northwestern Cement Products Association—Chicago Cement Show—Concrete Associations—American Civic Association—Technical Meetings—Civil Service—Technical Schools—Personal Notes

Indiana Sanitary and Water Supply Association.

The annual meeting of the Indiana Sanitary and Water Supply Association will be held at the Claypool Hotel, Indianapolis, February 25, 1910. Among the papers to be presented the following have been announced:

"The Recent Richmond Valuation," by H. A. Dill.

"A Sewage Purification Plant," by C. Brossmann.

"Development of Centrifugal Pumps," by C. H. Hurd.

"Progress in Stream Pollution Elimination," by Dr. J. N. Hurty.

"Value of Accurate Water Works Records in the Light of Some Recent Valuations," by Dabney H. Maury.

"Water Softening," by Edward Bartow.

"The Wisconsin Utility Commission's Workings as They Refer to Water Companies," by B. H. Meyer.

"Sewage Plant at Ft. Benjamin Harrison," by Maj. Fauntleroy.

"Some Construction Features in Filtration Plants," by C. Arthur Brown.

Other well-known experts are on the program, the titles of whose papers are not yet announced.

The members of the new Illinois Sanitary and Water Supply Association and the Ohio and Kentucky members of the Central States Water Works Association have been invited to attend.

Conference of Illinois Water Supply Officials.

A conference of Illinois water officials with the state water survey will be held at Illinois University, February 16 and 17. Among the papers to be presented the following may be specially mentioned:

"Duty of Pumping Engines and Cost of Pumping water," by H. M. Ely, C. H. Cobb and C. R. Henderson.

"The Relation of the State Water Survey to Municipal Water Works," by Edward Bartow.

"The Sanitary Condition of the Southern End of Lake Michigan, Bordering on Lake County, Indiana," by H. E. Barnard.

"Streams Pollution and Purification," by Professor T. J. Burrill.

"Methods of Bacteriological Examination of Water," by Frank Bachmann.

"Methods of Chemical Examination of Water," by Lewis I. Birdsall.

"Correlations of Deep Well Records," by Professor J. A. Udden.

"Advantages of a Filtered Water Supply from a Business Standpoint," by Owen T. Smith.

"A Water Works Laboratory," by C. H. Cobb.

"Suggested Disposal of Drainage at Tolono, Illinois," by Professor Edward Bartow.

"Number and Size of Fire Streams for Fire Protection," by George C. Habermeyer.

"Methods of Measuring Water," by Professor A. N. Talbot.

National Association of Cement Users.

Following are the principal subjects of papers to be presented at the convention of the National Association of Cement Users, to be held in Chicago, February 21 to 24:

"The Use of Concrete for Farm Buildings from the Sanitary Standpoint," by S. Cunningham, Jr., New York, N. Y.

"Laying Concrete Under Water—Detroit River Tunnel," by Olaf Hoff, Consulting Engineer, New York.

"Comparative Value and Cost of the Groined Arch in Large Reservoirs," by T. H. Wiggin, Senior Designing Engineer, Board of Water Supply, New York.

"Concrete for Maritime Structures," by Chandler Davis, Department of Docks and Ferries, New York.

"Application of Concrete in Barge Canal Work," by R. S. Greenman, Office of State Engineer and Surveyor, Albany, N. Y.

"Comparative Cost and Efficiency of the Pneumatic Reinforced Concrete Dam."

"Additional Notes on Use and Cost of Concrete for Small Houses," by R. C. Knapp, Philadelphia, Pa.

"Advantages and costs of Reinforced Concrete Construction," by J. P. H. Perry, Contracting Engineer, Turner Construction Company, New York.

"Cost and Advantage of Concrete Drain Tile," by J. H. Libberton, Assistant Inspecting Engineer, Universal Portland Cement Company, Chicago, Ill.

"Installation and Operation of a Steam Curing Plant," by F. S. Phipps, Manager Central Stone Company, St. Joseph, Mo.

"The Preparation of Concrete from Selection of Materials to Final Deposition," by Harry F. Porter, Consulting Engineer, Bridgeport, Conn.

"Reinforced Concrete Columns," by Robert A. Cummings, Pittsburg, Pa.

"Reinforced Concrete Columns," by Peter Gillespie, Lecturer, University of Toronto.

"Use of Concrete in Protecting Wooden Piles Against Teredo," by Ralph Barker, Assistant State Engineer, San Francisco, Cal.

As usual, the reports of committees will be an important feature of the meeting. These committees will present for consideration proposed standard building regulations for the use of reinforced concrete, and specifications for concrete street pavements, Portland cement sidewalks, curb and gutter, plain concrete drain tile and architectural concrete blocks.

The sections under the charge of the various committees will hold special sessions for topical discussion of the subjects included in their respective fields.

Northwestern Cement Products Association.

Owing to the prolonged illness of President Roche and the business absence and consequent resignation of Secretary Piffner, it has been decided not to hold the convention of the Northwestern Cement Products Association at St. Paul in March. Instead, the convention will be held in Chicago, February 18, at the Great Northern Hotel, in connection with the great Chicago Cement Show. L. V. Thayer and E. S. Macgown, of Minneapolis, are the committee on the program for the convention.

The Chicago Cement Show.

In connection with the great Chicago Cement Show, to be held at the Coliseum, Chicago, February 18 to 26, inclusive, Percy H. Wilson, secretary of the Association of American Portland Cement Manufacturers, will present an elaborate series of illustrated instructive lectures on twenty-two subjects connected with the diversified uses of concrete. Three lectures a

day will be given, at 4:30, 8 and 9 p. m., in the west end of the Balcony Annex. The list of subjects is long, and includes every conceivable use of cement.

There are now seven association meetings to be held in connection with the show. In addition to the cement and concrete associations listed below are the American Society of Engineering Contractors, February 24-26; the National Builders' Supply Association, February 23-24; the Illinois Association of Municipal Contractors, February 24-26; the Illinois Lumber Dealers' Association, February 16-18; and the Illinois Masons' Supply Association, February 16-18.

The rates to the show will be 1½ fares. Certificate of purchase of ticket to Chicago at full fare must be obtained of the agent when purchasing ticket, and this certificate is the only document that will entitle to a return ticket at half fare.

Conventions of Concrete Associations.

The number of applications for space for exhibits at the third annual cement show to be held in Chicago from February 18 to 26, 1910, has been so large that the balcony and the second floor of the annex to the Coliseum will be utilized for exhibits. A feature of the cement show will be a continuous moving-picture exhibition in charge of the Association of American Portland Cement Manufacturers.

Besides the cement show the following conventions have been scheduled for 1910:

Lincoln, Neb., February 1-4, Nebraska Cement Users' Association.

Chicago, February 18-24, Concrete Machinery Manufacturers' Association.

Chicago, February 21-25, National Association of Cement Users.

Chicago, February 18-21, Northwestern Cement Products Association.

Cedar Rapids, Ia., March 9-11, Iowa Association of Cement Users.

American Civic Association Honored.

The action of President Taft in becoming a member of the American Civic Association is regarded as proof that the aims of the association are, in a sense, part of the Taft policies, as they relate to the improvement of community life and the preservation and development of national scenic beauty.

Technical Meetings.

The sixth annual convention of the Iowa Association of Cement Users will be held in Des Moines, Iowa, March 9, 10 and 11. Ira A. Williams, sec'y., Iowa State College, Ames, Ia.

The fifth annual convention of the Nebraska Cement Users' Association will be held at Lincoln, Neb., February 1, 2, 3 and 4. Address sec'y., care Lindell Hotel, Lincoln, Neb.

The annual convention of the National Brick Manufacturers' Association will be held at Pittsburg, Pa., February 7, 8, 9, 10, 11 and 12. T. A. Randall, sec'y., Indianapolis, Ind.

The annual meeting of the Connecticut Society of Civil Engineers will be held at New Haven, Conn., February 8. J. Frederick Jackson, sec'y., Box 1304, New Haven.

The annual meeting of the Ohio Engineering Society will be held at Columbus, Ohio., February 8, 9 and 10. C. J. Knisely, New Philadelphia, Ohio.

The annual meeting of the New England Association of Gas Engineers will be held at Boston, Mass., February 16. N. W. Gifford, sec'y., 26 Central Square, East Boston, Mass.

The annual convention of the Iowa Engineering Society will be held at Cedar Rapids, Iowa, February 16 and 17. A. H. Ford, sec'y., Iowa City.

The annual meeting of the American Society of Engineering Contractors will be held at Chicago, Ill., February 24, 25 and 26. D. J. Hauer, sec'y., 721 Park Row Bldg., New York City.

At a meeting of the board of directors of the American Institute of Electrical Engineers held December 16, 1909, a resolution was passed authorizing the meetings and papers committee to arrange for a meeting of the institute at some suitable point in the South Atlantic States during the month of March, 1910. The committee decided that the meeting shall be held at Charlotte, N. C., March 23, 24 and 25. As now arranged the program comprises the following papers: "Economics of Hydro-Electric Plants," W. S. Lee; "Electric Drive in Textile Mills," A. Milmow; "Calcium Cyanamid and Its Relation to Water Powers," Charles H. Baker; "Gas Engines in City Railway and Light Service," E. D. Latta, Jr.; "Protective Devices for High-Tension Transmission Lines," L. C. Nicholson. In addition to a number of attractive social features, a tour of inspection will be made to the Great Falls (S. C.) stations of the Southern Power Co. and a 100,000-volt sub-station. The official headquarters will be at the Selwyn Hotel. The Charlotte meeting is not to take the place of the institute's annual convention, which will be held as usual later in the year. The annual dinner will be held at the Hotel Astor in New York City, February 24. Mr. Elihu Thompson, past president, who has been awarded the first Edison medal, will be the guest of honor.

The twenty-fifth annual convention of the Illinois Society of Engineers and Surveyors, held at Cairo, Ill., January 26 to 28, included the following papers: "The Relation of Typhoid Fever Death Rate to the Water Supplies in Illinois," E. Bartow; "Municipal Engineering Work at Cairo," W. B. Thistlewood; "Chicago's Sidewalk Problem," N. E. Murray; "Materials and Workmanship in Street Paving," W. W. Marr; "Municipal Ownership of Public Utilities," J. W. Dappert; "Sewage Disposal Plants for Small Institutions," G. C. Habermeyer; "Recent Examples of Sew-

age Purification," W. S. Shields; "Reinforced Concrete Construction," A. J. Widmer; "Reinforced Concrete Aqueducts," H. E. Reeves; "Tests of Road Materials," A. B. Slippy; "The Drainage and Protection of Lands Subject to Overflow," C. W. Brown; "The Legal Liabilities of Levee and Drainage Districts," J. V. Waddell; "The Tallahatchie Drainage District," A. L. Dabney; "The Maintenance of Open Ditches," E. H. Cowan; "Water Supply and Drainage Investigations in Illinois," R. I. Randolph; "Observations of Engineering in Europe," F. O. Dufout; "Developments in Road Construction," A. N. Johnson; "The County Surveyor," P. T. Hicks; "The Cairo & Thebes Railway," G. F. Dewey; "Steel and Concrete Bridge Work on the Illinois Central Railway," R. E. Gaut; "Monazite and Its Uses," S. K. Atkinson; "Railway Engineering at the University of Illinois," Prof. S. S. Roberts; "Mining Engineering at the University of Illinois," Prof. H. H. Stoek; "Instruction in Hydraulic and Water Supply Engineering," Prof. G. C. Habermeyer; "Instruction in Road and Pavement Construction at the University of Illinois," R. B. Slippy; "The St. Louis and Cairo Division of the Deep Waterway," J. W. Woermann.

The fifty-seventh annual meeting of the American Society of Civil Engineers was held in the Society House in New York City, January 19. Suggestions for members of the nominating committee were received from 1,366 members, or about 31 per cent. of the corporate membership. Members of the nominating committee were elected as follows: District No. 1, James C. Meem, Brooklyn; Dist. 2, J. R. Worcester, Boston; Dist. 3, H. C. Allen, Syracuse; Dist. 4, J. E. Greiner, Baltimore, Md.; Dist. 5, Isham Randolph, Chicago; Dist. 6, Richard Montfort, Louisville, Ky.; Dist. 7, R. H. Thomson, Seattle, Wash. The special committees on steel columns and struts, and bituminous materials for road construction, whose reports were printed in the December "Proceedings were continued. The reports of the special committees on rail sections and on engineering education were accepted and the committees continued. The special committee on uniform tests of cement reported that during the last year it had arranged with the Ottawa Silica Company, of Ottawa, Ill., to prepare and deliver standard sand at 2 cents per pound, f. o. b. cars Ottawa. A minority report was presented by Alfred Noble, in which he reviewed the history of the committee's work, pointing out that the committee had been very active previous to 1903, holding frequent meetings and having the proposed methods carefully tested. At that time, he stated, a full report would have been premature. Since 1903, however, the meetings have been growing less and less frequent, and the changes in the report originally presented have been very few. He believes that the methods have now been sufficiently proved, and that the committee ought now to change the phraseology of the report as it now stands so as to eliminate the indefinite terms, and present this revision as a final report. After considerable discussion a resolution was carried accepting the present progress report of the committee, and continuing the committee, and directing it to bring in a final report at the next annual meeting. Officers were elected as follows: President, John A. Bensel, New York City; vice-presidents, to serve two years, Col. John T. Fanning, of Minneapolis, and Hunter McDonald, of Nashville, Tenn.; treasurer, Joseph Knap, New York City.

The thirteenth annual convention of the Indiana Engineering Society was held in Indianapolis, Ind., January 13, 14 and 15. In his annual address President E. E. Watts referred to the industrial development in the state since the formation of the society in 1881, and of the increasing demand for technically trained men in engineering and contracting work. A number of technical papers were submitted at the various meetings, including one on "Concrete Sewer Construction," by F. W. Charles, and one on "Brick Paving of Highways in Delaware County," by J. O. Potter. In speaking on the subject of bituminous macadam road construction, Clarence A. Kenyon, of Indianapolis, made a comparison of the present practice in Indiana with that in some of the English cities. The importance of a good foundation and sand cushion in brick paving work was emphasized. Prof. W. K. Hatt, of Purdue University, commented upon tests of creosoted paving blocks. Sewage disposal and stream pollution were discussed, and a proposed design for a sewage disposal plant for Indianapolis was described by C. Brossman. The officers for the last year were re-elected as follows: President, Edwin E. Watts; vice-president, C. C. Brown; secretary and treasurer, Chas. Brossman. Directors—W. K. Hatt, C. A. Tripp, A. J. Hammond and W. C. Mabee.

The annual meeting of the New England Water-Works Association was held in Boston, January 12. Papers were submitted as follows: "Governmental Policy in Relation to Water Powers," Marshall O. Leighton; "The Maidstone Typhoid Epidemci," Dr. William P. Mason. Officers for the ensuing year were elected as follows: President, George A. King; vice-presidents, Allen Hazen, Ermon M. Peck, Michael F. Collins, Leonard Metcalf, Irving S. Wood and Frank A. McInnes; secretary, Willard Kent; treasurer, Lewis M. Bancroft; Editor, Richard K. Hale.

The Western Society of Engineers has elected the following officers for 1910: President, J. W. Alvord; vice-presidents, O. P. Chamberlain, A. Bement and W. K. Hatt, of Lafayette, Ind.; treasurer, A. Reichmann; trustees, L. E. Ritter, G. M. Brill, W. W. Curtiss. All are of Chicago except the one noted.

At the meeting of the Brooklyn Engi-

neers' Club, held January 13, Geo. A. Orrok presented a paper on "The Blast Furnace as a Power Producer." At the informal Thursday night talk of Jan. 27 J. C. Meem discussed "The Brooklyn Subways."

The Proceedings of the last convention of the National Municipal League have just been published in a volume entitled "Cincinnati Conference for Good City Government," which can be obtained from Clinton Rogers Woodruff, secretary, North American building, Philadelphia, Pa.

At the meeting of the New York Electrical Society Prof. W. S. Franklin, of Lehigh University, lectured in "The Practical Applications of the Gyrostat." The lecture was illustrated, a working model of the Brennan mono-rail car was exhibited and afterwards Richard Scherl and Paul Froelich, the inventors of the Scherl gyroscope monorail car described its operation. Elmer A. Sperry opened the discussion with a talk about some of the gyrostatic work with which his name is associated.

Civil Service Examinations.

The U. S. Civil Service Commission will hold examinations at the usual places as follows:

Feb. 16, 17: Assistant and junior geologists in Geological Survey at $1,000 to $1,600 a year or per diem for time employed. Computer in Coast and Geodetic Survey at Manila, Philippine Islands, at $1,600 a year. Hydraulic engineer in Water Resources branch of Geological Survey at $1,200 to $2,400 a year.

March 9, 10: Topographic draftsmen in Coast and Geodetic Survey at $900 and $1,000 a year.

The Technical Schools.

Recent publications of the University of Illinois are Bulletin 31 on "Fuel Tests with House-Heating Boilers," by J. M. Snodgrass, and Bulletin 32 on "The Occluded Gases in Coal," by S. W. Parr and Perry Barker.

The journal of the Sydney University Engineering Society, Sydney, New South Wales, for 1908, vol. xiii, has been received and contains a valuable list of papers, mainly on mining engineering, but including one on modern sewage disposal and one on repulsion motors, the latter by H. R. Hillman, a graduate of Cornell University.

Printed report No. 10 of the Columbia University fire-testing station, Ira H. Woolson, director, describes fire tests of reinforced cinder concrete floor arches constructed by the Trussed Concrete Steel Co. of Detroit.

The fortieth annual catalog of Worcester Polytechnic Institute, Worcester, Mass., is received. About half the book is taken for brief but very comprehensive statements of the work and facilities of the institute and half for lists of graduates and students, with full information concerning their locations and occupations.

Columbia University announces courses of lectures in works management in the department of mechanical engineering during the next four months, by Charles B. Going in February, by Charles U. Carpenter and H. L. Gantt in March, by Mr. Gantt, Walter M. McFarland, Harrington Emerson and Richard T. Lingley in April and by Mr. Lingley and Edwin J. Prindle in May. The Hewitt lectures on power at Cooper Union will be given in February and March by Charles E. Lucke. Full information about the lectures will be given by F. P. Keppel, secretary of Columbia University.

Personal Notes.

Albert J. Johnston has been elected mayor of Sarnia, Ontario.

A. Givan has resigned as assistant engineer at Sacramento, Cal.

J. H. Dingle has been elected city engineer at Charleston, S. C.

William H. Lawton has been elected city engineer at Newport, R. I.

Arthur M. Compton has been elected assistant city engineer at Davenport, Ia.

Former Mayor John F. Fitzgerald was elected mayor at Boston, Mass., January 11.

Wallace Greenalch has been reappointed commissioner of public works at Albany, N. Y.

Robert Robinson, Sr., former mayor of El Paso, Ill., died at his home in that city recently.

Josiah A. Briggs has resigned as chief engineer of the Borough of The Bronx, New York City.

Wilfred F. Alexander, city clerk of Eastport, Me., died in that city January 14, aged 68 years.

Charles W. Appleby has been apopinted city engineer at New Albany, Ind., succeeding Samuel Mann.

John W. Hill, consulting engineer of Cincinnati, has been appointed a member of the Ohio State board of health.

John H. Emigh, consulting engineer and formerly city engineer of North Adams, Mass., died in that city January 6.

Prof. Willard C. Fisher, of the Wesleyan University faculty, was elected mayor of Middletown, Conn., January 17.

R. B. Smith has been appointed chief engineer of the board of public service at Sandusky, Ohio, succeeding C. M. King.

J. Leland Fitzgerald, the new city engineer at Schenectady, N. Y., has appointed W. E. Weller deputy city engineer.

John M. Hackett has been elected city engineer for a term of two years at Dunkirk, N. Y., to succeed James P. Morrissey.

Dr. S. G. Kerr, who was the first mayor of Asheville, N. C., died at his home in Knoxville, Tenn., January 16, aged 84 years.

I. N. Russell has been appointed superintendent of water-works at Salem, Ohio, succeeding George L. Wells, deceased.

John Cherry, Sr., a well-known paving contractor in Illinois, died at his home in Jacksonville, Ill., December 29, aged 73 years.

J. H. Weatherford has been re-elected city engineer of Memphis, under the new commission form of government, for a term of two years. This is a special compliment to Mr. Weatherford under the

conditions which have existed heretofore in Memphis and shows the confidence of the commission in his ability and uprightness.

E. N. Chisholm, of Columbia, S. C., has been appointed superintendent and manager of the water-works system at Knoxville, Tenn.

Frank J. Eppele, county engineer of Mercer, N. J., has been elected president of the County Engineers' Association of New Jersey.

Dr. Ernest J. Lederle has been appointed health commissioner to succeed Dr. Thomas A. Darlington, by Mayor Gaynor, of New York City.

Harry S. Holton, first assistant to the chief engineer of the board of public service, Columbus, Ohio, has been appointed director of public service.

Dr. D. W. Moore has been elected mayor of Jellico, Tenn. W. G. Smith, Phil Francis, F. C. Moore, George Russell, George Ellison and S. C. Baird were elected aldermen.

Benjamin Chatfield has been appointed superintendent of streets and sewers at Waterbury, Conn., and John R. Walker has been appointed superintendent of water-works.

John B. Batt has been appointed superintendent of water-works at North Tonawanda, N. Y., succeeding E. C. Heidenfeldt. A. P. Smith has been reappointed city engineer.

Prof. H. K. Barrows and Prof. C. B. Breed, of the Massachusetts Institute of Techology, have formed a partnership under the firm of Barrows & Breed, and will conduct a general consulting practice in civil engineering.

James V. Costigan has associated with himself E. H. Cahoon and C. F. Beck, in the Portage Engineering Co., with offices in the Doyle block, Akron, Ohio, to practice civil, mining, hydraulic and municipal engineering.

R. B. Smith has been appointed chief engineer to the State board of control at Sandusky, Ohio, and W. C. Scott has been reappointed chemist and superintendent of the water filtration plant.

The mayor of Cincinnati, Ohio, has made the following appointments: Chief engineer, department of public service, F. H. Shipley; superintendent of water-works, Robert Laidlaw; superintendent of distribution, J. A. Hiller; superintendent of filtration, J. W. Ellms; engineer of street and sewer repair department, H. L. Conway. Mr. Shipley has been superintendent of the street and sewer repair department and Mr. Conway engineer in the track elevation and subway department.

Prof. Edward W. Bemis, superintendent of water-works at Cleveland, Ohio, has been appointed first deputy commissioner of the department of water supply, gas and electricity, New York City.

A. J. Hammond, M. Am. Soc. C. E., has resigned as city engineer at South Bend, Ind., and has established an office for general practice as civil and hydraulic engineer at 207 Summers building, South Bend.

W. A. McFarland, M. E., and Carroll Beale, C. E., Assoc. Mem. Am. Soc. C. E., have associated themselves to practice mechanical and civil engineering, with offices in the Washington Loan and Trust building, Washington, D. C.

W. C. Hollyday has resigned as superintendent of the water-works department of Columbus, Ohio, and W. W. Jackson, until now superintendent of machinery, has been temporarily appointed superintendent of the entire water-works department.

M. L. Worrell has been selected for the third time as superintendent of public works of Rome, Ga., in active charge of the water, sewer and street departments. He is the executive officer of the board of public works, whose members are level headed business men, looking for results and not for the payment of political debts.

City engineers have been appointed or elected as follows: Woonsocket, R. I., Frank H. Mills, re-elected; Dunkirk, N. Y., John M. Hackett, succeeding James P. Morrissey; Gloversville, N. Y., Morrell Vrooman, reappointed; Terre Haut, Ind., D. M. Roberts, succeeding E. B. Schmidt; Richmond, Ind., Fred R. Charles, reappointed; Natchez, Miss., O. M. Fowler, re-elected.

Swearingen and McCulloh are civil and consulting engineers at Great Falls, Mont. Mr. Swearingen has graduated from the city engineer's office, which position he held for fourteen years, and Mr. McCulloh from the positions of city engineer at Havre and later of assistant city engineer of Great Falls. They are demonstrating their ability by their work in designing sewer and water-works systems for Montana cities as well as in street, boulevard and park work.

MACHINERY AND TRADE

Aluminum Drafting Instruments.

The Ready Mfg. Co., Rochester, N. Y., are putting on the market a number of drawing instruments made of a special hard grade of aluminum at prices but slightly in advance of wood or amber, while their durability compares favorably with that of high priced steel instruments. They do not warp, rust or tarnish and should last a lifetime.

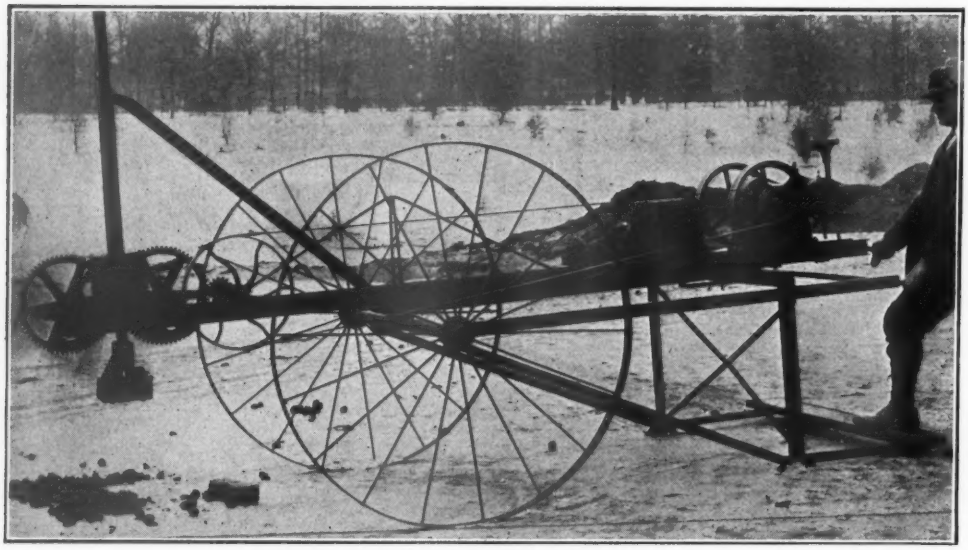
The instruments include railroad curves, protractors, circular and semi-circular, straight edges, T-squares and the "Ready" drafting instrument.

The latter has one arm about 6 inches long and another about 2½ inches long, with connecting straight and circular bars. It can be used with pin and pencil as a pair of compasses drawing circles differing in diameter by sixteenths of an inch from

¼ to 11 3-16 inches, as a protractor for drawing or determining angles with both long and short sides, it serves as a T-square and as a triangle, and is small enough to carry in the pocket and substantial enough not to be injured easily, and it costs only 50 cents. One side is graduated to 1-16 inches and ¾ scale and the other to 20ths or metric scale as preferred.

The Staley Power Tamping Machine.

The Staley power tamping machine is a machine designed to accomplish by power and in a thorough and workmanlike manner that laborious and often neglected operation in engineering works, the tamping of the back filling in trenches and other excavations where it is desired there shall be no future sinking of the back filling. This is especially desirable where pavements are to follow excavation operations. The machine has a large field in the many operations which require the opening of improved streets, as with the power tamping the back filling and foundation may be tamped so firmly in place that the pavement may be relaid to grade without danger of a future depression in the replacement. It also has a large field in construction of cement walks, as the foundation may be firmly and cheaply tamped with the power tamper, also in many other operations which require tamping.



THE STALEY POWER TAMPING MACHINE.
For Earth Filling and Concrete.

The machine consists of two principal parts, a two-wheeled truck built of steel, properly braced and with the necessary handles and foot board conveniently located for the operator; a sweep made of two 3-inch steel channels mounted on a saddle near the center placed on a pivot on the truck axle, which gives the sweep a free horizontal movement. The rear end of truck has a sliding bearing on a cross member of the truck. On the front end of sweep is mounted the tamping mechanism. On the rear end is placed the air-cooled gasoline motor which is the power plant. The tamping mechanism is of the well known board drop hammer type; the board or plunger slides in steel guides attached to the steel channels. The plunger is lifted by two lifting rolls mounted on shafts running in bearings on the channels. The rolls are geared together by equal gears and are driven by a shaft and pinion gearing with one of the larger gears. The front lifting roll has a slight movement controlled by springs to enable it to grip the plunger. The length of stroke and releasing of the plunger are automatically controlled by cutting away a part of the circumference of the lifting rolls. The upper travel of the plunger is limited by reducing the thickness of the plunger near the lower end, which prevents the lifting rolls from gripping the plunger at this point. The plunger is retained in the upper and inoperatve position by means of two dogs or cams which, when it is desired to stop the plunger, are released and, engaging the side of same, prevent the fall of the plunger. . These dogs or cams do not prevent the upward movement of plunger, so when they are released to control the plunger it is automatically run to the upper position. The tamping head may weigh up to 100 lbs.

The speed may be 60 to 75 strokes per minute and the drop up to 24 inches. The drop is by gravity.

In operation on trench work the machine would be placed straddle of trench. The operator is at rear end and may stand at one corner of truck where he can reach the sweep, which is moved horizontally for the transverse movement. The truck is pushed forward for the longitudinal movement. Thus any point within the range of machine may be struck. It will be seen that only the length of stroke is regulated; the position of tamping head is regulated only by the material being tamped and may be any place from the surface to six feet below. The tamping heads may be of any shape and can be changed in a few minutes. On solid footing one man with machine can do as much work as 6 to 10 men with hand tamper. As the machine is driven by power it does not get tired but stays right on the job.

The machine is put on the market by R. H. Staley, 305 Unity Bldg., Springfield, Ill.

Hydrated Lime Makes Waterproof Concrete.

The city of Kingston, Ont., built a gas holder with a circular concrete wall to hold the water seal. Poor concrete and poor workmanship caused the tank to leak so badly that it could not be used. In the spring of 1909 a contract was given to Lucius E. Allen, of Belleville, Ont., and Edward B. Merrill, of Toronto, two civil engineers, to make the tank water tight and they proceeded as follows:

The vertical wall was chipped back from three to six inches by means of pneumatic chisels and hand drills and the old concrete surface was systematically roughened and cleaned so as to secure the thorough adhesion of the new concrete. Special forms made on the principle of the stage or bridge used in theatres were made and the work of laying concrete was carried on continuously so far as possible, a complete ring being placed continuously.

The wall is now composed of a 3-inch thoroughly waterproofed concrete, proportioned 1-2-4 with about 18 per cent of high calcium hydrated lime added to the mass at the time of mixing. The materials used were Lehigh Portland cement, clean and well graded lake sand, crushed limestone and Crown hydrated lime. Special precautions were taken to insure thorough tamping of concrete, and the mixture was made sufficiently wet to flow freely.

Within three months from the time work commenced the tank was placed in commission and frequent tests have since been made by the city engineering department, which show a maximum leakage of under ten gallons of water in 24 hours, which may be accounted for by evaporation or absorption.

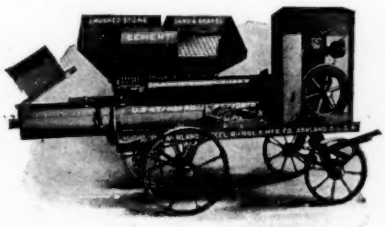
The holder, having now been in constant use for several months, is considered satisfactory from every standpoint, and the improvement is permanently completed.

The Crown hydrated lime is made from limestone 98 per cent pure calcium carbonate by the Marblehead Lime Co., 1105 Masonic Temple, Chicago, and 609 R. A. Long building, Kansas City, Mo., who use the vacuum process of hydration, the first successful process with high calcium lime for producing a dry hydrate.

The United States Standard Continuous Concrete Mixer.

The accompanying cut shows the United States Standard continuous concrete mixer made by the Ashland Street Range and Manufacturing Co., Ashland, O., the latest design of which was patented August 17, 1909.

The arrangement of hoppers and slides for automatic measurement of the aggregates and simultaneous discharge into the mixer can be seen in the cut. The box for measuring cement is seen at the end.



UNITED STATES STANDARD CONTINUOUS CONCRETE MIXER.

The feed from these hoppers is automatic and accurate, and it is only necessary to keep the hoppers and the cement box supplied with sufficient material.

The gasoline engine, mounted on the same truck, concentrates the power and its application as much as possible, and the box which encloses the engine protects it from the dust of the mixer.

Full information about the mixer and the excellent cement building block machine which they manufacture will be sent by the company on request.

The Secrets of Cement.

The Superior Portland Cement Company, with mills at Superior, Ohio, and offices in Cincinnati, tells all its secrets in a descriptive booklet now in press. In other words, the Superior people have nothing to hide, telling how their product is made, of what it is made and why it will last for ages. The reader takes a little journey to the company's mill, where he is entertained by Mr. J. B. John, who built and operates the plant. The trip is illustrated in an interesting way with fine half-tones and has an educational trend without being too technical or too involved in the science of the subject.

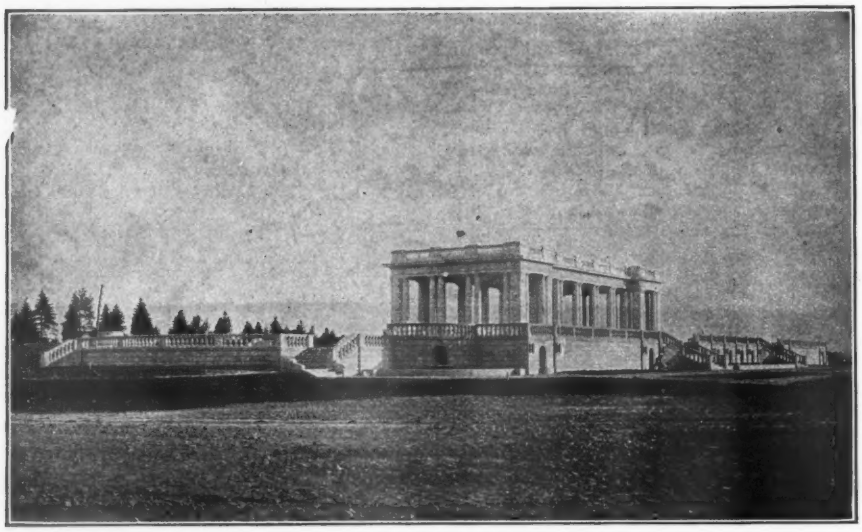
The idea is to tell the scientific story of Superior in a popular way. The booklet will be mailed free to those who ask for it.

The Book of American Municipalities.

The Book of American Municipalities for 1909 has just been issued by the Municipal Information Bureau of Chicago, which seems to have a close connection with the League of American Municipalities. It contains an authentic summary of civic progress and achievements. It contains full data from 83 of the larger cities of the United States, prepared according to a common standard form by a city official in each city, and is a valuable means of comparison of the results of municipal government in the cities listed. It costs $3.50 and can be obtained of the Municipal Information Bureau, 95 Dearborn street, Chicago, Ill.

The Cheesman Memorial.

The accompanying photograph shows the Cheesman Memorial, a handsome park structure in Denver, Col., designed by Mareau and Norton, architects. The structure is of white marble laid up in stainless white cement mortar and the surrounding walls, railings, balustrades, etc., are of concrete made with white cement. The Medusa white cement made by the Sandusky Portland Cement Co., Sandusky, O., was used.



CHESSMAN MEMORIAL, DENVER, COLO.

Prizes for Designs for Cement Houses.

The one branch of concrete construction which seems to have lagged behind the others in rapidity of development, is in residence construction. While considerable progress has been made in this field recently, it is nevertheless to be observed that architects and builders have rather neglected the possibilities of concrete in the building of homes, notwithstanding the fact that a concrete house offers several advantages of fire-proofness, permanency and low insurance. In this connection, it is interesting to note that the Pittsburg Architectural Club has taken steps to encourage and stimulate the interest of the architectural profession in cement house construction. The club is at present sponsor for a competition for designs for a cement house and garage which is attracting considerable interest among architects throughout the country.

The competition is open to practically all the architects in the country, and prizes, amounting to $500, are offered by the Universal Portland Cement Co., of Chicago and Pittsburg.

The designs will be exhibited at the fifth annual art exhibition at the Carnegie Institute Galleries at Pittsburg, and will probably be published later in booklet form by the cement company.

The jury will consist of:

Mr. Edward Stotz, president Pittsburg Chapter A. I. A.; Mr. Henry Hornbostel, dean department of architecture, Carnegie Technical Schools; Mr. Henry McGoodwin, assistant dean, Carnegie Technical Schools; Mr. J. Beatty Orth and Mr. D. E. Allison.

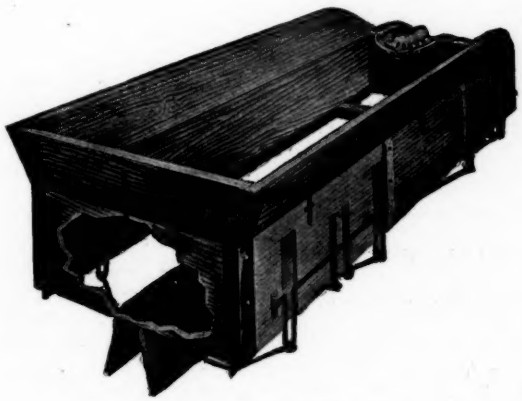
In making the reward the jury will consider the artistic quality of the designs, in regard to the materials used, the excellence of the plan, and the practicability of the constructive details, and will en-

deavor to obtain a design in which the imagination and ideas of the designer, in regard to good architecture, are practically and successfully worked out.

Drawings are to be delivered flat to the Pittsburg Architectural Club, Carnegie Institute, Pittsburg, Pa., not later than 12 noon, February 16. Detailed information can be obtained by addressing the club or the Universal Portland Cement Co.

The Chicago Quick Dumper.

The accompanying cut shows the Chicago quick dumping wagon bed, made by the Black Manufacturing Co., 215 to 219 West Ohio St., Chicago, Ill. It is a wagon bed which can be mounted on the ordinary wagon wheels and frame and is, as its name suggests, a quick dumper, for it opens promptly and completely, leaving the smallest possible obstruction to the fall of the material in the box and no opportunity for it to clog on the surfaces of the sides or bottom of the box. The mechanism for dropping the bottom leaves and returning them to place is of the simplest and can be seen in most part on the side of the bed in the cut. It is operated by the driver without leaving his seat. Those attending the Chicago Cement Show will find the company's representatives there and can also see the wagons at the ware rooms and in use in the city.



THE CHICAGO QUICK DUMPER.

The Fisher Power Tamping Block Machine.

The illustration herewith is the latest type of a power concrete block machine, and by its use the mortar is rammed by heavy hydraulic pounding displacing the air and bringing together the aggregates as one unit. Water is necessary to the crystallization of cement and it is necessary to use some power that will bring the aggregates together, permitting the cement to bond them. Many efforts have been made and many structures have proved unsatisfactory for the reason that this was not done.

The initial set begins soon after the mixing of the cement and water together, extending from two to four hours and in this time the silicates are formed and the strength and imperviousness of the stone depends largely on this early crystallization of these silicates. The quantity of water must be right. Too much is as bad as not enough. The correct amount of water is between a semi-wet mix and a pouring mix, called a plastic mix, which complies with all the specifications of architects and engineers.

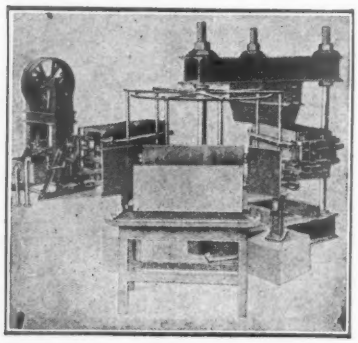
Now this hydraulic ramming of a plastic mixed concrete bringing the aggregates together into close union thus attaining the necessary density and obtaining crushing strength and a small percentage of absorption of water.

This system is not new as for years the inventor of this machine has had before the public a powerful ramming hydraulic press, and the quality of the product has never been questioned. But the expense of manufacturing this machinery and equipment has placed it beyond many who desired to use it and to the production of machinery that could be adopted and used by those desiring a true concrete, the inventor has given much thought. His system and machinery should be carefully investigated with a view to ascertain if it does produce a product with these qualities, placing the concrete block at the head of the building product of our country.

The machinery spoken of is driven by a 2-plunger hydraulic pump, and on the gauge is registered the power of the blows, which are sufficient to displace the air. Around the center strain rod is pinioned a table mounted on wheels, and on this table are fastened three mold boxes, that rotate from the filling table to the

press, to the delivery, and then again to the filling table, permitting the three mold boxes to be in operation all at the same time, one receiving the load, one being pressed, and one unloading, the operation requiring about one minute. Two men are sufficient to develop a large production of concrete blocks in a day's work.

The mold boxes are so arranged as to make a face either down or up, any style of one or two-piece solid, hollow or angular block. Any designed face pattern can be used as the delivery is made by bringing the front side over, turning the block on its side, resting on the pallet. When removed it frees itself from the pattern, making a convenient and easy operation outfit with a capacity suitable to its location and demand.



FISHER HYDRAULIC BLOCK MACHINE.

The inventor of this machinery has given great thought combined with his knowledge to the production of a dense concrete by hydraulic ramming, and to the perfecting of a machine to meet all the demands of the concrete block manufacturer. He would be pleased to give any information regarding this machinery to those desiring it. Ask for a catalogue of the Fisher Hydraulic Stone and Machinery Company, 26 Builders Exchange Bldg., Baltimore, Md.

Tests of Street Cleaning Machines in New York City.

The Commissioner of Street Cleaning in New York City, William H. Edwards, has had some tests of street cleaning machines made by District Superintendent A. F. Gunther, as a basis of information for the consideration of contracts for the next street cleaning season. The figures in the following table were compiled by E. D. Very, the engineer of the department, and are selected from the table showing the experiments in all the street cleaning districts because the districts shown in the accompanying table are the only ones in which the squeegee was tested.

The pavements are asphalt, granite and wood block, gone over as they were found, except that the squeegee was used on smooth pavements only.

It will be noted that the squeegee in every case cleaned the largest number of square yards per day and in every case but one used the smallest amount of water per 1,000 square yards.

This machine is made by the Kindling Machinery Co., of Milwaukee, Wis., who will give full information about it and the success it has attained.

Make of Machines.	No. of Days Test.	No. of Machines Tested.	No. of Square Yards per Machine per Day.	Gallons of Water Used per 1,000 Square Yards.
District No. 2.				
American	35	4	15,200	393
Connelly	23	2	16,800	480
Sanitary	47	4	13,406	995
Squeegee	20	2	21,247	404
District No. 5.				
Byers	47	3	9,827	666
Connelly	14	2	28,980	328
Sanitary	28	4	32,792	314
Squeegee	18	2	47,491	153
District No. 6.				
Connelly	23	2	26,689	463
Sanitary	31	2	27,347	385
Squeegee	15	2	68,948	125
District No. 7.				
Byers	47	2	15,137	675
Connelly	35	2	51,567	272
Sanitary	14	4	28,234	371
Squeegee	16	2	75,161	91
District No. 9.				
Connelly	25	2	38,572	273
Sanitary	13	2	25,522	324
Squeegee	18	2	46,142	121

A price of 13 1-3c per 1,000 gallons is charged by the city of New York to the street commissioner.

A Machine for Tapping Water Pipes Under Pressure.

The high state of development of the automobile is due the fact that men interested in its production did not rest when they had made a successful machine. They sought to better it, and kept on bettering it until they brought it to its present state.

This same policy has brought the Mueller Water Tapping Machine to its present high efficiency. The late H. Mueller was not satisfied with merely inventing and making a machine. He improved it and kept on improving it, each time adding to its effectiveness. The earlier machines were good, so good in fact that many of them are still in use. One man in Texas bought one of the early machines in 1884. He says it still does its work and is as good as ever, even though it lacks the improvements that have been made since.

The Mueller Water Tapping Machine of today embodies all the original points of the old one, but it has advantageous conveniences that make the work of tapping

easier. There is, however, nothing intricate about a Mueller Water Tapping Machine. Any one can use it by merely following directions. After the body has been securely fastened to the main, the boring bar holding the combined drill reamer and tap is inserted and the brass cap securely screwed down. The gate in the machine is opened, the feed yoke is thrown up over the collar and the machine is ready for operation. When the main has been tapped the tool is backed out, the gate closed and the tool removed. The corporation cock then takes the place of the tool in the boring bar, and is inserted in the body of the machine as was the tool. The advantage of this is obvious. The corporation cock must go straight to

MUELLER WATER PIPE TAPPING MACHINE.

the tap. It is just like re-inserting the tool or taking a wood screw out and putting it back in the same hole.

The Mueller Water Tapping Machine is easily handled, but it has plenty of weight to withstand the heavy strain that is necessarily entailed by tapping heavy mains. Literature giving full descriptions of these machines, the manner of operating, etc., together with complete illustrations, will be furnished on request by either the Decatur, Ill., or New York office of the H. Mueller Mfg. Company.

Slide Rule for Reinforced Concrete Slabs.

The slide rules are becoming so numerous and convenient that the engineer can safely forget his computing ability. The latest received by the writer is the slide rule for computing reinforced concrete slabs, designed and copyrighted by Prof. Arthur W. French, C. E., of Worcester Polytechnic Institute, Worcester, Mass. It has two slides and three fixed scales. The span in feet of the slab, the factors for simple and continuous spans, the load per square foot, the bending moment, the total slab depth and the area of cross section of the reinforcing steel are the scales on the rules, by the setting of which one quantity can be found if the others in its equation are given. On the scale of cross section of reinforcement are also given the sizes and shop numbers of expanded metal, Clinton cloth and A. S. & W. wire mesh corresponding thereto, and the sizes of square bars and round rods for spacings of 4, 5 and 6 inches. Thus, given the span, load and slab depth, the metal required can be taken directly from the slide rule, and any other arrangement of known and required quantities can be made and the results obtained with the same ease.

The rule is of inexpensive construction and is graduated with all the accuracy required for its problems. Its price is $2. It is of pocket size, 4½ by 9 inches. The back carries the standard formulas and tables of sectional areas and weights of steel per foot width and per square foot of slab for various spacings and diameters of rods and bars.

Machinery for Pavements and Roads.

C. B. Smith, the chief engineer of the Atlas Dryer Co., Cleveland, O., was a recent caller at the office of MUNICIPAL ENGINEERING. He soon imbues a listener with his own enthusiasm over the dryer which his company is selling and for the design of which he is most largely responsible, and is quite as convincing about their one-car portable asphalt paving plant.

Mr. Smith is not satisfied with his past successes but is working hard on some much needed machinery for road building, with the chances almost unanimously in favor of his success.

Trade Publications.

Winnipeg, Man., is distributing calendars and maps demonstrating the strategic position of Winnipeg in the commerce of western Canada.

Tonindustrie Zeitung, the standard German publication in the clay and cement industries, has issued its usual annual calendar in three parts, one a pocket diary, one a handbook of information from the field and one a list of standard makers of and dealers in machinery and materials.

The offices of Advertising and Selling Magazine have been moved to the seventh floor of Masonic Hall Extension, 71 W. 23rd St., New York City.

Part six of "Building Details," published by Frank M. Snyder, architect, New York, has just been issued.

The Scofield bar for reinforcing concrete is described in a circular issued by the Scofield Engineering Co., Arcade Bldg., Philadelphia, Pa.

Transite Asbestos Wood is the subject

of a circular of the H. W. Johns-Manville Co., New York.

Bulletin No. 68 of the Universal Portland Cement Co. shows a miscellaneous lot of photographs of large and small work in which Universal Portland cement has been used.

Bitu-Mass Paving is described, with the machine for laying it, in a booklet of the American Paving and Manufacturing Co., Indianapolis, Ind.

The Weber-Duller Co., Houston, Tex., are engineers and contractors in civil hydraulic and sanitary engineering. They use the Thompson system of garbage crematories, which they are now putting before all the municipalities of the country, since the Thompson system is applicable to small as well as large cities. They use the Weber system for construction of concrete chimneys. David M. Duller, C. E., is the general manager of the company. He will send pamphlets descriptive of these two systems as well as of other classes of work in their field.

The Chicago Concrete Tool and Specialty Co., who will exhibit at the Chicago Cement Show, issue catalogue F of barrows, dump carts and an asphalt cutter.

The Edison Aggregate describes the Chelsea dock improvement in New York City, in which Edison cement was used. The piers are built to receive the largest ocean steamers and the land entrances and buildings are in keeping with the character of the dock work.

The latest circular of the Lehigh Portland Cement Co., in addition to a number of miscellaneous pictures, goes into detail regarding the Indiana State Tuberculosis Hospital, and the cover is a reproduction of a photograph of the finish of the surface of the concrete foundations.

Recent publications of the Jeffrey Mfg. Co., Columbus, O., are Booklet 34 on Jeffrey standard elevator buckets, Booklet 33 on Jeffrey wire cable conveyers, Catalog 69B of Jeffrey screens, and Bulletin No. 17 of Jeffrey mine locomotives.

"Placing Concrete in Freezing Weather" is the title of T. W. K. No. 4 issued by the Vulcanite Portland Cement Co., Philadelphia and New York.

Keuffel and Esser Co., New York and Hoboken, N. J., issue a pocket calendar and a solar ephemeris for 1910 as reminders of their business as dealers in instruments and supplies for engineers, draftsmen and surveyors.

The American Asphaltum and Rubber Co., Harvester Bldg., Chicago, Ill., has issued a handsome booklet showing the successful use of their Pioneer road asphalt for making roads and streets and the methods of construction. Their Pioneer reservoir waterproofing asphalt and Pioneer mineral rubber pipe coating are also very successful, and all three have passed the experimental stage.

Trade Notes.

ASPHALT.

Cleveland, O.—(Special.)—The Atlas Dryer Company is building one of its Atlas one-car portable asphalt paving plants, 1910 edition, for the Metropolitan Construction Company, of Kansas City, Mo. This is the third order received by this company from the Metropolitan Construction Company.

Reading, Pa.—E. B. Ulrich, city engineer, recommends, in his annual report, the purchase of an asphalt repair plant.

Pittsburg, Pa.—The board of reviewers has begun condemnation proceedings to acquire property for a site for a municipal asphalt plant.

Kansas City, Mo.—The new municipal asphalt repair plant has been completed at a cost of $30,000.

Wichita, Kas.—Rackliffe & Gibson, of St. Joseph, Mo., contemplate establishing a branch office here, making a specialty of Hassam paving.

BRICK.

Crawfordsville, Ind.—Fremont Alfrey, who has purchased 100 shares of stock of the Standard Brick Co., contemplates building new kilns and making other improvements.

CEMENT.

Birmingham, Ala.—The cement plant under course of construction at Ragland is about completed. Plans are being made by C. W. Hill & Co., engineers, for an addition to the plant, which the promoters fell convinced is necessary, owing to the growth of the demands for cement since they began the construction of the plant.

Easton, Pa.—The Alpha Portland Cement Co. held a special meeting Jan. 20, 1910, at Alpha, N. J., to consider a proposition to merge the Alpha Portland Cement Company with the Cement Mfg. Company. The latter company was recently formed to take over a portion of the property of the Alpha Portland Cement Company.

Omaha, Neb.—The Nebraska Portland Cement Company will make its headquarters in this city. The company's manufacturing plant will be established at Superior, Nuckolls county, a railway center for southern Nebraska and northern Kansas. The capacity of the plant will be 2,500 barrels daily. The testing laboratories of the company will be located at Kansas City.

Kansas City, Mo.—Negotiations are in progress for the merging of the cement plants at Iola, Kas., Dallas, Tex., South Pittsburg, Tenn., Des Moines, Ia., Independence, Kas., and Neodesha, Kas.

The Sandusky Portland Cement Co., of Sandusky, O., reports its pure white stainless Portland cement used on the following important jobs: Hospital, Ellis Island, N. Y.; Emigrants' Bank, New York City; National Museum, Washington, D. C.; Alfred Washington's residence, Glencoe, Ill.; Providence Hospital, Seattle, Wash.; Soulard Public Baths, St. Louis, Mo.; Mrs. Robt. Stafford's estate, Huntington, L. I.; H. R. H. Prince of Wales' racquette court, at Marlborough House; O. C. Barber's estate, Barberton, O.

Their Medusa waterproof compound was used in the following: Naval Y. M. C. A. basement and swimming pool, Norfolk, Va.; Rainier-Grand Hotel extension basement, Seattle, Wash.; Butler Bldg., San Francisco, Cal., basements 80 feet below sea level; Western Union Newspaper Bldg., Chicago, Ill.; swimming pool, University of Minnesota, Minneapolis, Minn.;

large building, 31st and 5th ave., New York, being waterproofed by the Hedden Construction Co.; Soulard Public Baths, St. Louis, Mo.; Gary Light, Heat & Water Co., power building, Gary, Ind.

CONCRETE BLOCKS.

Indianapolis, Ind.—The Indiana Concrete and Machinery Co. has been incorporated to conduct a general concrete and machinery business, by Carey L. Smith, Henry Bowser and James C. Hill.

Galveston, Tex.—The Gulf Concrete Cement Company has been incorporated by Capt. Alf Bryde and Daniel Wallis, of this city, who will soon establish industries in Galveston, Harris and other counties in this state for the manufacture of concrete piling. The company will use methods and patents controlled by the Portland, Ore., Cement Pile and Equipment Co.

Windom, Minn.—The removal of the cement tile plant of Mr. Doolittle, of Webster City, Ia., to this city is under consideration, providing $5,000 worth of stock in the company, to be organized, is taken by the citizens.

Columbus Junction, Ia.—E. A. Shaver, of Wellman, Ia., will establish, during next summer, a cement brick and tile plant here.

PURCHASE OF MATERIALS.

Lansford, Pa.—(Special). Edward J. Jones advises us that he is in the market for 100,000 paving brick.

Jasper, Ala.—(Special.)—J. R. Smith, C. E., desires prices on materials for paving sidewalks and streets.

PURCHASE OF MACHINERY.

Lansford, Pa.—(Special). Edward J. Jones advises us that he is in the market for three steam rollers and two cement mixers.

Doon, Ia.—(Special). John Swimmy advises us that he is in the market for a concrete mixer.

Jasper, Ala.—(Special.)—J. R. Smith, C. E., advises us that he desires to purchase machinery and tools for constructing sewers.

LIGHT, HEAT AND POWER.

New York City.—The Hartwick Power Co. has been incorporated to manufacture electricity for light, heat and power. The incorporators are Lawrence J. Mayer, 216 W. 100th st., and Carleton Bune, 244 W. 57th st., New York City; Frank L. Hilton, 11 Bentley ave., Jersey City, N. J.

Houston, Tex.—The Houston Gas Bill Reducing Company has been incorporated by J. C. Robinson, H. T. Fisher and C. I. Peckham.

MISCELLANEOUS.

Fulton, N. Y.—The Fred Pierce Sand Co. has been incorporated to sell sand, gravel, stone and building materials, by George F. Stackhouse, 16 New st., East Orange, N. J.; Albert M. LeMessuier, 215 Elk st., Syracuse, N. Y.; Claude E. Gurle, 512 Broadway, Fulton, and others.

Findlay, O.—The Buckeye Traction Ditcher Co. contemplates building an additional factory.

Dallas, Tex.—The General Fire Extinguisher Co. has been incorporated by Richard W. Finley, Sidney S. Smith and James W. Conaway.

Allentown, Pa.—The Catasaqua Construction Co. has been organized to construct bridges, sidewalks and roads, by Alvin J. Hoffman, William A. Follweiler, Samuel A. Wenrich and Calvin D. Peters.

Patents on Concrete Posts and Poles.

879,076. Post Mold. Jonas H. Wiest, Indianapolis, Ind.

881,747. Artificial Stone Fence. Louis Townsend, Evansville, Ind.

882,131. Concrete Fence Post. Franklin P. Van Hook, Normal, Ill.

882,439. Fence Post Mold. Jordan D. Williams, Indianapolis, Ind.

883,005. Post. John H. Doddridge, Vincennes, Ind.

883,022. Cement Post. Chas. Hornshaw, Port Huron, Mich.

883,491. Fence Post (concrete). Louis H. Scott, Princeton, Ill.

883,569. Mold for Fence Posts. Harvey H. Rodgers, Good Hope, O.

883,913. Fence Post. Geo. W. Pyle, Geneva, Ind.

884,171. Pole (reinforced concrete). Diedrich W. Krellwitz, St. Catharine's, Ont., Can.

884,502. Fence Post Mold. Chas. F. Kyser, Saranac, Mich.

887,206. Mold for Forming Artificial Stone Posts. John E. Logan, Kansas City, Mo.

887,498. Concrete Fence Post. Henry A. McElhinney, Detroit, Mich.

887,796. Means for Protecting Poles, Piles and Posts from Decay. Edward B. Harang, Chicago, Ill.

888,719. Fence Post. Chas. A. Mendenhall, Farmland, Ind.

889,091. Mold for Posts. Harvey Ballinger, Marion, Ind.

891,246. Post (concrete). Hiram H. Grissom, Balbec, Ind.

892,592. Post and Tile Mold. Frank and Chas. J. Helm, Traverse City, Mich.

892,826. Reinforced Concrete Post. Ira L. Graham, Payne, O.

892,880. Pole (wood, steel and concrete). Robert S. Orr, Pittsburg, Pa.

893,156. Fence Post. Harry M. Fewins, Woodbine, Ia.

893,734. Cement Post Fastener. Chas. B. Ingraham and Aurel L. Moser, Laurel, Ia.

894,794. Fence Post. Jas. H. Hufford, Muncie, Ind.

895,691. Fence Post Molding Apparatus. Louis H. Scott, Princeton, Ill.

895,981. Fencing Fastener for Fence Posts. Jeremiah J. Dickson, Indianapolis, Ind.

897,632. Concrete Fence Post. Chas. Kubach, Abilene, Kans.

897,773. Fence Post. Arnold Pagel, Racine, Wis.

898,671. Apparatus for Molding Bases on Fence Posts. Marshall C. Munn, Sycamore, Ill.

899,416. Multiple Mold for Fence Posts. Chas. Kubach, Abilene, Kans.

901,449. Metal Reinforced Concrete Post. Lemuel J. Husted, Denver, Col.

904,098. Mold for Fence Posts. Jesse B. Storms, Albion, N. Y.

904,487. Fence and Hitching Post (concrete). Wm. H. Kessler, Merwin, Mo.

905,794. Method of Constructing Fence Posts. Zachary T. Crego, Columbus, O.

907,494. Mold (for concrete posts). Frank B. Harding and John J. Brubeck, Rockville, Ind.

909,875. Mold for Making Cement Fence Posts. Joseph M. Denning, Cedar Rapids, Ia.

910,620, 910,621. Post and Brick Molds. Cyrus S. Wert, Kendallville, Ind.

910,843. Reinforced Concrete Post. Jas. Needs, Fakenham, Eng.

911,584. Concrete Fence Post. Harley L. Ford, Ottumwa, Ia.

912,249. Machine for Molding Bases Upon Fence Posts. Chas. S. Long, Aurora, Ill.

IMPROVEMENT AND CONTRACTING NEWS

PAVING.

Springfield, Mass.—Arthur A. Adams, superintendent of streets, in his annual report asks for a larger appropriation for streets during the next year.

CONTEMPLATED WORK.

Norfolk, Neb.—Norfolk ave. will be paved.

Lestershire, N. Y.—Paving is contemplated for Main st.

Neenah, Wis.—Concrete paving is contemplated in Sherry st.

Alton, Ill.—About 2 miles of brick paving is contemplated.

Dayton, O.—Paving is contemplated for Germantown st.

Dundee, Neb.—Asphalt and other paving is contemplated next spring.

Fond du Lac, Wis.—Cement paving is contemplated in Armory and Sixth sts.

Kent, Wash.—Brick paving is contemplated for Front st. and Meeker ave.

Denton, Tex.—The macadamizing of E. Hickory st. is again being urged.

Marion, Ia.—Resolutions have been passed for paving 13 blocks of streets.

Webster City, Ia.—Council will soon take up the question of paving extensions.

San Diego, Cal.—Plans and specifications have been prepared for repaving H st.

Ames, Ia.—Creosoted wood block paving is contemplated for Onondaga st.

Pasadena, Cal.—Brick paving is contemplated for S. Pasadena ave.

Eagle Grove, Ia.—The city council contemplates paving 6 blocks of Broadway.

Reading, Pa.—Paving is proposed for Spruce and Chestnut sts. Mayor Rick.

Binghamton, N. Y.—New macadam paving is contemplated for Front st. this year.

Harrisburg, Pa.—Mayor Meals is in favor of paving the street intersections.

Escanaba, Mich.—Additional asphalt paving is contemplated in N. Mary and S. Mary st.

Vinton, Ia.—Council has appointed a committee to investigate the paving question.

Tonowanda, N. Y.—A petition is being circulated asking that Morgan st. be paved.

Harvard, Ill.—The question of paving several streets is being considered by the council.

Willimantic, Conn.—The mayor recommends, in his annual message, the paving of Main st.

Scranton, Pa.—The residents in North Park are in favor of paving Electric st. with asphalt.

Oceanside, Cal.—Plans are being prepared for constructing a macadam boulevard in Hill st.

Eveleth, Minn.—Plans will be prepared by cy. engr. Austin for paving 6 blocks of Grant ave.

Harlan, Ia.—Paving is contemplated for the public square and the streets leading to the depot.

Duluth, Minn.—Bids will probably be asked in March for paving E. Superior st. and Lake and 1st aves. R. Murchison, clk. B. P. W.

Beloit, Wis.—About 1 mile of brick paving is proposed for Prairie ave. Robt. Caldwell, cy. engr.

Greenview, Ill.—The construction of more concrete sidewalks is contemplated next spring and summer.

New Orleans, La.—Bitulithic paving is contemplated for Prytania st. and granite blocks for Hurst st.

Menasha, Wis.—Plans have been prepared for constructing concrete paving in Racine and other streets.

Platteville, Wis.—Plans will be prepared for paving Main st. with brick. P. D. Hendershot, Jr., cy. clk.

Elizabethtown, N. Y.—Brick paving is contemplated for the main street in the village of Lake George.

Irvington, N. J.—An ordinance has been passed providing for flagging Laurel ave. W. L. Glorieux, mayor.

Pekin, Ill.—The property owners in Park ave. have decided in favor of brick paving with cement filler.

Greensville, Tenn.—Voted to issue bonds for constructing 3½ mis. of streets in this city. Pike comrs.

York, Pa.—The property owners in Duke st., between Philadelphia and Market sts., are in favor of repaving.

Des Moines, Ia.—Plans and specifications are being prepared and bids will be asked soon for paving 21 streets.

South Omaha, Neb.—Specifications have been submitted for paving 39th ave. and 39th st. with Purington brick.

Eldora, Ia.—Council is considering the question of constructing about 1 mi. of creosoted wood block or brick paving.

Hamilton, Ont.—Voted to issue $200,000 bonds for asphalt paving on concrete base. J. A. Macallum, cy. engr.

Lebanon, Pa.—An ordinance has been passed providing for an appropriation of $1,000 for improving and macadamizing 7th st.

Elkhart, Ind.—A resolution has been adopted for improving S 2nd st. and Redding ave. Objections will be heard Feb. 7.

Lincoln, Ill.—A petition is being circulated asking that Kickapoo st. be paved with mineral rubber asphalt instead of brick.

Tacoma, Wash.—Council voted to construct cement sidewalks in S. 10th and other streets, and pave 6th ave. with asphalt.

Tucson, Ariz.—The mayor, in his annual message, recommends the paving of the streets in the business section of the city.

Pasadena, Cal.—A contract will be let in about 3 weeks for paving Broadway st. with vitrified brick. Heman Dyer, cy. clk.

Peoria, Ill.—Brick paving on concrete base is contemplated for S. Garfield ave. and W. Armstrong st. Objections will be heard Feb. 7.

Ames, Ia.—Council will take final action Feb. 21 on the proposed paving of Onondaga and other streets with creosoted wood blocks.

Los Angeles, Cal.—A contract will be let soon for constructing about 3 mis. of

the Los Felix road, from Hollywood to San Fernando.

Raleigh, N. C.—An ordinance has been passed providing for brick paving in Fayetteville and Martin sts. and the streets about Capitol Square.

Appleton, Wis.—Plans will be submitted to the city council Feb. 2 for about $50,000 worth of street paving. C. H. Vinal, cy. engr.

Spokane, Wash.—Plans have been completed for grading, curbing and constructing sidewalks in Rich ave. and for paving Howard st. with brick.

Oconomowoc, Wis.—Plans have been prepared for paving N. Main and Milwaukee sts. with cement concrete, vitrified brick and creosoted wood blocks.

Newton, Ia.—The city council has directed the city solicitor to prepare resolutions for constructing about 45 blocks of new paving next summer.

Altoona, Pa.—In his annual message the mayor recommends $100,000 for continuing the street paving, and $75,000 for resurfacing wornout asphalt paving.

Chicago, Ill.—The bd. of local impvts. has deferred final action until April 20 on the formal petition for widening Michigan ave. as a surface boulevard.

Rock Island, Ill.—Ordinance are proposed providing for 36 blocks of new brick and asphalt paving, at a cost of $172,121.90. G. W. McCaskrin, mayor.

Rock Island, Ill.—The property owners in 11th ave. from 9th to 22nd, are urging the revival of the ordinance for paving with asphalt.

Galveston, Tex.—The comr. of sts. has been directed to ask for bids for paving 25th st. from Avenue A to Winnie st. with vitrified brick. Mayor Fisher.

Atlantic City, N. J.—The city engineer has been directed to prepare plans and specifications for paving Hammock ave. and other streets with bitulithic or other material.

Crawfordsville, Ind.—A resolution has been passed providing for the construction of cement sidewalks in Water st. from Market to College. Fred B. Robinson, cy. clk.

South Orange, N. J.—John F. McDonough, chmn. st. com., has recommended that the streets of this village be treated with oil next summer instead of being sprinkled with water.

Sheboygan, Wis.—The bd. of pub. wks. recommends vitrified brick paving and stone curbing in S. Water and other streets, and macadam paving in Maryland ave. and other streets.

Bloomington, Ill.—Brick paving, stone curbing and cement and asphalt filler are contemplated for Jefferson, Evans, Main, Grove, Gridley, Washington and Madison sts. Cy. engr. Folsom.

Milwaukee, Wis.—The property owners in Holton st., from Reservoir to North ave., voted to circulate three petitions, providing for bitulithic, creosoted blocks and Kettle river sandstone.

Des Moines, Ia.—The city council will take final action Feb. 7 on creosoted wood block paving in 8th st., cement curbing in Clark and 42nd sts.; asphalt paving in 42nd st.; cement curbing in 35th st.

Wichita, Kas.—The property owners in S. Lawrence ave. advocate bitulithic paving for a distance of ¾ mi. Resolutions have been passed for paving Roosevelt ave. with brick blocks; 1st st. with creosoted wood blocks; Circle Drive, brick blocks.

Wauseon, Wis.—(Special). O. A. Wennberg, asst. cy. engr., says that city council, at its regular meeting, held Jan. 4, directed B. C. Gowen, cy. engr., to prepare plans and specifications and submit them at a special meeting of the council to be held Jan. 19, for the construction of about 200,000 sq. yds. of brick or creosoted wood block pavement. The contract will be let in March.

CONTRACTS TO BE LET.

Normal, Ill.—Bids are asked until Feb. 5 for paving Broadway. Bd. local impvts.

Oconomowoc, Wis.—Bids are asked until Feb. 11 for improving Collins st. B. P. W.

Ocean Park, Cal.—Bids are asked until April 1 for a steam road roller. Cy. coun.

Norfolk, Va.—Bids are asked until Feb. 8 for repaving Granby and Chapel sts. with smooth material.

St. Paul, Minn.—Bids are asked until Feb. 21 for the Birch Lake ave. road. Ed. G. Krahmer, co. audt.

Monticello, Ind.—Bids are asked until Feb. 8 for constructing stone roads. A. G. Fisher, co. audt.

Cincinnati, O.—Bids are asked until Feb. 11 for improving certain roads. Fred Dreihs, clk. co. comrs.

Kentland, Ind.—Bids are asked until Feb. 7 for constructing a macadam road. Elmer R. Bringham, co. audt.

Kearney, Neb.—Bids are asked until Feb. 16 for improving 5½ mis. of dirt road. E. A. Miller, co. audt.

Jefferson Barricks, Mo.—Bids are asked until Feb. 5 for constructing roads, walks, etc., here. Capt. Stanley H. Ford, Q. M.

Gibson, N. C.—Bids are asked until Feb. 7 for constructing 2.7 mis. of sand and clay roads. J. C. Mason, chmn. co. road com.

Gordon, Ala.—Bids are asked until Mar. 15 for constructing 51 mis. of graded road in Houston county. W. J. Parish, co. comr.

Moline, Ill.—Bids are asked until Mar. 1 for constructing driveways, etc., in part of Riverside cemetery detached for park purposes.

Palatka, Fla.—Bids are asked until Feb. 5 for constructing a hard-surfaced road. S. Woren, clk. bd. trustees for co. bds., 722 Water st.

Pipestone, Minn.—Bids are asked until Feb. 25 for removing obstructions at the falls and improving the highway to the cemetery. Wm. S. Campbell, supt.

Raleigh, N. C.—Bids are asked until Feb. 2 for constructing 25,000 sq. yds. of brick paving in Fayetteville and other streets. R. B. Seawall, cy. engr.

CONTRACTS AWARDED.

Kendallville, Ind.—The contract for paving was awarded to Fred Hoffman, of Rochester, for $40,625.

Fulton, N. Y.—The contract for paving N. 1st st. was awarded to J. A. Fitch, of this city, for $9,055.

Portland, Ore.—The contract for 28,000 sq. yds. of bitulithic paving was awarded to the Warren Construction Co.

Ironton, O.—The Ironton Construction Co. was awarded the contract for paving 4th st. with brick, for $12,859.

East St. Louis, Ill.—The Myers Construction Co. was awarded the contract for improving 25th st. for $16,301.

Millvale, Pa.—John Battenfield & Son, of this city, was awarded the contract for grading, curbing and paving Sample st.

Ligonier, Ind.—The contract for paving with Nelsonville block was awarded to Tripett & Son, of Peru, for $13,320.

Winnetka, Ill.—The contract for street improvement here was awarded to James Cape & Sons, of Racine, Wis., for about $20,000.

Wharton, Tex.—The contract for draining and curbing around the public square was awarded to E. E. Carson, for $3,400.

Salt Lake City, Utah—Contracts for

paving 9th East st. and 1st ave. have been awarded to P. J. Moran, for $151,474.47.

Winston, N. C.—The Atlantic Bitulithic Co. secured the contract for constructing 6,700 sq. yds. of bitulithic paving.

Davenport, Ia.—The McCarthy Improvement Co. was awarded the contract for all the brick paving ordered in certain streets.

Mobile, Ala.—The Jett Brothers Contracting Co. was awarded the contract, Jan. 6, for paving Water st. with cement, for $5,438.98.

San Diego, Cal.—The contract for paving Union and Front sts. was awarded to the Fairchild-Gilmore-Wilton Co., at 16.3 cts. a sq. ft.

South Bend, Ind.—The contract for paving Prairie st. with brick, comprising 30,922 sq. yds., was awarded to H. M. Barnes, for $56,000.

Fort Worth, Tex.—(Special). The Texas Bitulithic Co. was awarded the contract for paving Missouri and College aves. with bitulithic.

Guthrie, Okla.—The contract for paving Washington st. with asphalt was awarded to the J. F. Hill Paving Construction Co., at $1.94½ a sq. yd.

Houston, Tex.—A. T. Lucas was awarded the contract for constructing brick paving in Washington, San Jacinto, Travis and Main sts., for $32,152.

Puyallup, Wash.—(Special). The contract for constructing 19,000 sq. yds. of bitulithic paving was awarded to the Warren Construction Co.

Ford, Mich.—The contract for constructing Metropolitan brick paving in Biddle ave. was awarded to J. E. Conley & Co., of Dayton, O., for $65,000.

Sumter, S. C.—The contract for constructing about 4,000 sq. yds. of cement sidewalks was awarded to J. D. McGee, of Greenville, at 89 cts. a sq. yd.

Little Rock, Ark.—The contract for paving W. 8th st. with macadam, with asphalt binder, was awarded, Jan. 5, to M. D. L. Cook, of this city, for $13,068.

El Paso, Tex.—(Special). The contract for constructing 9,170 sq. yds. of bitulithic paving in S. Orange st. was awarded to the Texas Bitulithic Co.

Logansport, Ind.—The contract for constructing a new sidewalk on the east side of Cicott st. bridge across the Wabash river was awarded to S. S. McKinney.

Lenoir, N. C.—The contract for grading and macadamizing about 3 mis. of road near here has been awarded to Hart & McAbee, of Hickory, N. C., for about $25,000.

Schenectady, N. Y.—The contract for paving Altamont ave. was awarded to the Union Paving Co., 525 State st., at $2.20 a sq. yd. for asphalt, and $2.42 for brick.

Newbern, N. C.—The contract for constructing about 45,000 sq. yds. of brick paving was awarded to Rowe & Page, of Charleston, S. C., at $1.41 a sq. yd., for about $60,000.

Columbus, O.—Paving contracts have been awarded as follows: Glenwood ave., Trimble block, Wm. H. Luchtenburg & Co., $32,472; Center ave., Geigler & Carns, $9,176; 9th st., Budd & Bortling, $5,400; Scioto st., Harry J. Shaw, $9,896.

Indianapolis, Ind.—Contracts for paving have been awarded as follows: Layman ave., brick, George McCray, $2.79 per ft.; sidewalks and curbs in 28th st., Lawson & Kincaid, $1.29 a sq. ft.

Ottumwa, Ia.—Contracts were awarded, Jan. 3, including 10,000 lin. ft. of curbing, for paving as follows: Brick paving, 16,000 sq. yds., J. C. Black, of this city; creosoted wood block paving, A. C. Morrison, of Minneapolis, Minn.

Mexico City, Mex.—The Mexican government has approved a contract between the government and the Compania Asphalto y Construcciones, one of the Doheny interests, for the construction of 30 new asphalt streets in this city. The contract price is $3.15 gold per square meter.

Long Beach, Cal.—Street paving contracts have been awarded as follows: C. W. Brashear, Heilman Bldg., Los Angeles—Appleton st., $20,276; Railway st., W., $13,019; American ave., $32,154; Fairchild-Gilmore-Wilton Co., Pacific Electric Bldg., Los Angeles, Railway st., E., $17,721. C. H. White—Linden ave., $40,086; Kennebec st., $1,152.

New York City—Bids were submitted Jan. 18 for repairing and maintaining sheet asphalt pavements in Manhattan, as follows: Barber Asphalt Paving Co., 30 Church st., New York, $118,700; Uvalde Asphalt Co., 1 Broadway, New York, $128,975; Sicilian Asphalt Co., $184,100.

SEWERS.

CONTEMPLATED WORK.

Wolsey, S. D.—A sewerage system is contemplated.

Prescott, Ont.—Voted to issue bonds for the extension of sewers.

Huntsville, Ala.—The city council is negotiating for a new sewerage system.

Monrovia, Cal.—Will vote on the construction of a sewerage system.

Chatham, N. J.—Voted to issue bonds for constructing a sewage disposal plant.

Corydon, Ia.—The construction of a sewerage system is contemplated.

Carterville, Ga.—Surveys will be made at once for constructing a sewerage system.

Edmonds, Wash.—This city has decided to construct a strunk sewer.

Boise, Idaho—Will vote, Mar. 1, on the issue of bonds for constructing a storm sewer.

Canton, Ill.—Plans are being prepared for rebuilding and enlarging the sewerage system.

Mandan, Ia.—Plans and specifications are being prepared for constructing a sewerage system.

Morristown, Tenn.—Voted to issue bonds for constructing a sewerage system. D. C. Morris, cy. recdr.

Duluth, Minn.—Plans are being prepared for a sewerage system at Rice's Point and Minnesota Point.

Berkeley, Cal.—Plans are being prepared for improving the sewerage system. J. J. Jessup, cy. engr.

Geneva, N. Y.—Commissioners Bowen and Henry have been appointed a committee to consider the matter of sewage disposal.

Galveston, Tex.—The construction of a large concrete drain in the East End is contemplated. Mayor Fisher.

Westfield, N. Y.—Plans for a sewerage system, including a sewage disposal plant, have been submitted.

Davenport, Ia.—City Engineer Murray has submitted plans and specifications for 4,400 ft. of sewer along the levee front.

Missouri Valley, Ia.—Surveys for a sewearge system have been prepared by the Iowa Engineering Co., of Clinton, Ia.

Lake Charles, La.—Surveys have been completed and preliminary plans for a sewerage system will be ready about Feb. 20.

Jefferson, O.—An ordinance has been passed authorizing the construction of a sewage disposal plant and sewerage system.

Houston, Tex.—A hearing will be held Feb. 7 on the petition for the establishment of Harris county drainage district No. 4.

Omaha, Neb.—City Engineer Craig advocates the construction of storm water sewers in the down-town business district.

Wheatland, Wyo.—The question of installing a sewerage, water works and electric light system is under consideration.

Kingston, N. Y.—Voted to construct about 9 mis. of sewers and a sewage disposal plant. Geo. N. Bell, engr., Kingston.

Roseville, Cal.—The construction of a sewerage system and improved streets is under consideration. F. C. Hill, cy. clk.

Savannah, Ga.—J. W. Howard, cy. engr., has been directed to prepare plans for the extension of the house drainage system.

North Adams, Mass.—Surveys have been made for constructing sewers in the western end of the city. R. L. Gardner, cy. engr.

Monroe, Wash.—The city council has ordered the construction of a trunk sewer, and bids will soon be asked for its construction.

Binghamton, N. Y.—Plans are being prepared for the extension of the Conklin ave. trunk line sewer. John A. Giles, cy. engr.

Attleboro, Mass.—Will vote in February on the advisability of constructing a sewerage system. Dr. C. S. Holden, chmn. sewer com.

Tuscaloosa, Ala.—Plans are being prepared and the contract will be let soon for constructing sanitary sewers. W. H. Nicol, cy. engr.

Columbus, O.—A resolution has been adopted for the construction of a sewer in State st., and bids will soon be asked for its construction.

Kansas City, Mo.—Plans have been completed for constructing the Brush Creek sewers, and bids will be asked for soon. J. L. Darnell, cy. engr.

Colton, Cal.—Plans have been completed and the question of constructing a sewer will be voted on in February. W. L. Martin, cy. engr.

Memphis, Tenn.—The residents in the extreme southern and eastern parts of this city are to have a sewerage system as soon as the plans are completed.

Pekin, Ill.—The city council recommends that a contract be made with J. W. Alvord, of Chicago, to prepare plans for constructing a sewerage system.

Providence, R. I.—Council has passed a resolution to petition the legislature for permission to issue an additional $500,000 for sewer construction.

Marcus Hook, Pa.—An ordinance has been passed providing for the installation of sewerage system and sewage disposal plant. Harry A. Lewis, chief burgess.

Paterson, N. J.—The matter of constructing the proposed sewerage system in the Lakeview district will probably be taken up in the spring. H. J. Harder, cy. engr.

Colfax, Wash.—The council of Garfield has under consideration the construction of a sewerage plant, comprising over 2 mis. of pipe, a septic tank, 2 filter beds, etc.

Pensacola, Fla.—This city contemplates the construction of storm sewers for the drainage of 40 to 50 acres in the northwestern part of the city. L. Earle Thornton, cy. engr.

Belzona, Miss.—Surveys are being made for the construction of a system of sewers, comprising about 4 or 5 mis. of pipe sewers, discharging into the Yazoo river.

Detroit, Mich.—J. J. Haarer, comr. pub. wks., advocates the construction of 2 trunk sewers, one in the western and one in the northwestern sections of the city.

Portland, Ore.—A resolution has been adopted for constructing a sewerage system in E. 3rd st., Union, Grand and other avenues and streets. J. W. Morris, cy. engr.

Pittsfield, Mass.—In his annual message the mayor recommends the construction of a sewer from Elm st., near Root Place, southeasterly to the river, and easterly along the river front into the Lakewood tract.

Bellefontaine, O.—The city solicitor has been directed to prepare a resolution authorizing the director of public works to employ an engineer to prepare plans and specifications for a sewerage system and disposal plant.

Rochester, N. Y.—E. A. Fisher, cy. engr., has completed surveys and investigations for a new sewage disposal system, which provides for carrying the sewage direct to the lake after passing through a reduction plant to be built at Irondequoit.

Harrisburg, Pa.—Mayor Meals has signed the $1,041,000 loan bill, providing for an intercepting sewer along the river front, additional street sewers, paving of intersections, improvement of Paxton creek, and building a bridge at 13th and one at Walnut sts.

CONTRACTS TO BE LET.

Iowa City, Ia.—Bids are asked until May 6 for constructing a sewere in Walnut st.

Kent, Wash.—Bids are asked until Feb. 7 for installing a number of lateral sewers. Cy. clk.

Chicago, Ill.—Bids are asked until Feb. 2 for constructing 2,340 ft. of conduit. I. J. Bryan, clk. san. dist.

Louisville, O.—Bids are asked until Feb. 7 for constructing sewers and sewage disposal works. Harry L. Rebrassier, vil. clk.

Lawton, Okla.—Bids are asked until Feb. 16 for constructing a sanitary sewer system for the north addition to this city. John D. Kennard, C. E.

Syracuse, N. Y.—Bids are asked until April 1 for constructing 3 mis. of Harbor Brook improvement, including the construction of an intercepting sewer. Intercepting sewer bd.

St. Louis, Mo.—Bids are asked until Feb. 11 for constructing a new 5 to 11-ft. concrete and brick sewer in the new North Harlem Creek joint sewer dist. Maxime Reher, prest. B. P. I.

El Paso, Tex.—Bids are asked until Feb. 3 for constructing incinerating and sewage pumping station, force main and sewage disposal works, with appurtenances, etc. Percy McGhee, cy. clk.

Toronto, Ont.—Bids are asked until Feb. 15 for constructing sewer outlet, sewage tanks, supply of sludge valves, penstocks, special tile, c. i. pipe, etc. Bids by registered post only. Jos. Oliver, chmn bd. control.

Baltimore, Md.—Bids are asked until Feb. 9 for constructing contracts 46, 47, 48, 49 and 9, sanitary sewer system, including power and pump houses, conduits, circular drains, etc. C. W. Hendrick, ch. engr. sewer com.

Woodson, Ark.—Bids are asked until Feb. 9 for constructing 9 mis. of levee, requiring 165,700 cu. yds. of excavation, 8 culverts, 8 gates, floodgate and reinforced concrete. Woodson Levee Dist., at office of Lund & Hill, 201½ W. 2nd st., Little Rock.

Washington, N. J.—Sealed bids are asked until Feb. 14 for constructing about 8 mis. of vitrified pipe sewers, 8 to 18 in.,

with Y branches, manholes, flush tanks, and other necessary appurtenances, and sewage disposal works. Dr. G. B. Smith, mayor; A. J. Craft, boro clk.

Canby, Minn.—Bids are asked until Feb. 8 for constructing 8,600 ft. 6-in., 8,400 ft. 8-in., 1,200 ft. 10-in., 1,450 ft. 4-in., 4,075 ft. 6-in., 350 ft. 8-in., 800 ft. 10-in. tile sub-drain, 50 manholes, sewage settling tank, gasoline engine, centrifugal pump, sewage well and pump house. P. O. Sherrum, cy. recdr.

CONTRACTS AWARDED.

Bakersfield, Cal.—The contract for constructing a septic tank was awarded to Sam G. Smart, for $14,500.

St. Paul, Minn.—The contract for constructing a sewer in Otto ave. was awarded to John Lind, for $6,973.

Claremore, Okla.—The contract for building a sewer in an alley was awarded to the New State Paving Co.

Monterey, Cal.—The contract for constructing a storm sewer in Dickman ave. was awarded to John Taufnir.

Chicago, Ill.—The contract for constructing the S. 52nd ave. sewer was awarded to the Federal Improvement Co., for $288,040.

San Francisco, Cal.—The Metropolitan Construction Co. was awarded the contract for constructing a sewer in Fulton st., for $58,937.

Syracuse, N. Y.—The contract for constructing the Harbor Brook intercepting sewer was awarded to Chas. T. Hookaway, for $4,714.70.

Lincoln, Neb.—The contract for constructing a reinforced concrete conduit for Antelope creek was awarded to C. D. Campbell, of this city, for $39,900.

Raymond, Miss.—The contract for installing a tank and sewer system for the court house and jail was awarded to H. D. Gaston, of Jackson, Miss., for $4,500.

Sapulpa, Okla.—The contract for constructing a brick trunk sewer was awarded, Jan. 10, to Summers & Stone, 312 Security bldg., Oklahoma City.

Milwaukee, Wis.—The contract for constructing a concrete relief sewer in Brown st. has been awarded to G. E. Zimmerman, of this city, for $18,793.

Chickasha, Okla.—The contract for constructing a storm concrete sewer, brick and vitrified pipe, was awarded to T. W. Roberts, of this city, for $38,870.

Muskegon, Mich.—The contract for constructing 8 mis. of sewers was awarded to George C. Berkey, of the Northern Construction Co., of Elkhart, Ind., for $45,000.

Lawrence, Kans.—The contract for constructing 1,500 ft. of sewer was awarded to Graeber Bros., at 55 cts. a ft., $80 for flush tank; galvanized water pipe, 22 cts. a ft.

Clinton, Ill.—The contract for constructing a tile drainage ditch in the Wapella and Clintonia drainage dist. No. 1 was awarded to H. S. Walter, of Cisco, Ill., for $13,000.

Dormont, Pa.—The contract for constructing a sanitary sewerage system was awarded to the Sawders Paving & Construction Co., 26th st. and Allegheny Valley Ry., Pittsburg, for $27,000.

Alliance, O.—The contract for constructing 2 mis. of sewer in Broadway was awarded to J. O'Neil, of Akron, O., for $28,043, and the contract for the sewage disposal plant to J. C. Devine, of this city, for $92,003.

Detroit, Mich.—Bids were opened Jan. 5 for furnishing and erecting machinery for a sewage pumping station located at the foot of Parkview ave., to include 2 centrifugal pumps, boilers and other machinery, as follows: Keating Bros., Detroit, $122,450; Camden Iron Works, Camden, N. J., $112,500; Allis-Chalmers Co., Milwaukee, Wis., $118,900.

Holton, Kans.—The contract for constructing a sewerage system and disposal plant was awarded, Jan. 13, to S. M. Kerns, of Denver, Col., for $41,365.94.

WATER WORKS.

San Diego, Cal.—This city laid 41½ mis. of water mains during 1909.

Houston, Tex.—An ordinance has been introduced providing for the reduction of water meter rates from 30 to 15 cts. per thousand gallons.

Trenton, N. J.—The Municipal Filtration Co., of Philadelphia, has been incorporated to construct and equip reservoirs, filters, irrigation plants, sewerage systems and sanitary water plants, by James B. Lockbridge, Philadelphia; Eccleston Barnett, New York City; Wm. H. Banker, Passaic.

CONTEMPLATED WORK.

Graham, Tex.—A filtration plant is proposed.

Morristown, Tenn.—This city will extend the water mains.

Sodus, N. Y.—A water works system is proposed.

Cheraw, S. C.—A water works system is contemplated.

Quincy, Ill.—The purchase of a new pump is contemplated.

Wilson, Kans.—Plans are being prepared for a water works system.

Flint, Mich.—The installation of a new pump has been recommended.

Edison, Ga.—Voted to issue bonds for constructing a water works system.

Aurora, Ore.—The construction of a small water works system is contemplated.

Gadsden, Ala.—Council has asked for $75,000 to extend the water works system.

Bessemer, Ala.—This city voted to purchase the water works plant for $500,000.

McAlester, Okla.—Voted to issue bonds for constructing a water works system.

Rosenberg, Tex.—The question of constructing a water works system is being discussed.

Red Hill, Pa.—Voted to issue bonds for constructing a municipal water works system.

Plaquemine, La.—The water works system, recently destroyed by fire, will be rebuilt.

Cottage Grove, Ore.—Plans have been completed for the proposed gravity water system.

Manchester, N. Y.—The construction of a municipal water works system is contemplated.

Edinboro, Pa.—Will vote Feb. 15 on the issue of bonds for installing a water works system.

Waterloo, N. Y.—Will vote Feb. 8 on the question of the improvement of the water supply.

Farmington, N. Y.—Will vote soon on the issue of bonds for constructing a water works system.

Manchester, Conn.—A new water supply system, preferably an artesian well system, is proposed.

Salt Lake City, Utah.—The construction of a large number of water mains has been recommended.

Drain, Ore.—Will vote soon on the issue of bonds for constructing a water works system and sewers.

Prosser, Wash.—This city will issue $30,000 bonds for installing a water works and sewer system.

Pella, Ia.—A water works system is

contemplated, although nothing definite has yet been decided upon.

Cherokee, Kans.—Voted to issue bonds for constructing a water works system. M. Reid, chmn. water com.

Leon, Ia.—Bids may be received about Mar. 1 for constructing a water works system. S. A. Gates, mayor.

Brigham City, Utah.—Will vote Feb. 8 on the issue of bonds for installing a municipal water works system.

Mountain View, Okla.—Preliminary plans are being made for a water works, sewer and electric light system.

Pittsburg, Pa.—An ordinance was passed Jan. 10 providing for 2 sets of pumping machinery for the filtration plant.

Shellman, Ga.—The installation of an air-lift pump, reservoir and the extension of the water mains is contemplated.

Kansas City, Kans.—Will vote soon on the issue of $500,000 bonds for the improvement of the water works system.

San Francisco, Cal.—Voted to issue $45,000,000 bonds for the development of the Lake Eleanor-Tuolumne river water supply.

Sacramento, Cal.—In his annual message Mayor M. R. Beard recommends that the Holly pump at the water works be replaced by a new pump.

Albion, N. Y.—The taxpayers voted, Jan. 20, to raise $2,500 for use in trying to locate sources of water supply for supplying this village.

Toledo, O.—The council committee on public improvements approved, Jan. 12, the ordinance providing for a high-pressure fire main system for the down-town district. Geo. W. Towson, cy. engr.

Kansas City, Mo.—Plans and specifications for a new 48-in. intake pipe from the Missouri river to the Quindaro pumping station have been authorized by the fire and water board. Wm. Clough, cy. clk.

Denison, Tex.—(Special.)—W. B. Berry, supt. Denison City W. W., says this city is planning an extension of tunnels for increased water supply. Information regarding channel machines and drills is desired.

San Diego, Cal.—The question of voting on the issue of $1,000,000 bonds for constructing a municipal office building, erecting 3 fire engine stations, N st. conduit, laying water mains, sewers, etc., is being considered.

St. Joseph, Mich.—(Special.)—A. W. Osborn, supt. W. W., advises us that the bd. of pub. wks. has been directed to prepare plans, specifications and estimates of cost for constructing a purification plant for the water works system.

Ridgway, Pa.—(Special.)—H. B. Norton, chmn. water com., advises us that this borough is in the market for the following: One 125-h. p. gas engine; one multistate or triplex power pump; four quills, with pulleys and clutches; two belts, 22 in. by 60 ft.; one 8-in. float valve.

Warren, O.—B. C. Smith, cy. engr., advises us that the election to be held Jan. 15, to vote on the issue of $250,000 bonds for water works, has been postponed. An attempt will now be made to secure better rates from the private company now operating, and in case of failure in this, the taxpayers will then be asked to vote on a bond issue for a municipal water plant.

CONTRACTS TO BE LET.

Burlington, Ia.—Bids are asked until Feb. 2 for constructing a pumping station. Co. supvrs.

Midland, Tex.—Bids are asked until Feb. 15 for constructing a water works system. J. H. Haley, mayor.

Milford, Ia.—Bids will be received about Mar. 1 for constructing a water works system. W. M. Quaife, mayor.

Toronto, Ont.—Bids are asked until Feb. 15 for furnishing c. i. pipe, iron castings, special tile, etc. Jos. Oliver, chmn. bd. control.

Salt Lake City, Utah—Bids are asked until Feb. 4 for constructing the City Creek aqueduct, including dam for catchbasins, and excavation for settling pond above dam. Geo. F. McGonigle, cy. engr.

Dallas, Tex.—Bids are asked until Feb. 16 for constructing the foundation for the pumping station, building the dam, spillway, and other appurtenances at White Rock reservoir site. J. B. Winslett, cy. secy.

CONTRACTS AWARDED.

Gotebo, Okla.—F. C. Brooke & Sons, of Jackson, Mich., secured the contract for constructing a water works system, for $24,180.

Bryan, Tex.—A franchise for a water works and electric light system has been granted a Mr. Cleaver and associates, of Houston, Tex.

Plattsburg, N. Y.—The contract for constructing a new reservoir dam on Meade brook was awarded to J. J. Fitzpatrick & Sons, for about $31,000.

Wheeling, W. Va.—A contract for erecting a stone pump house and drill a well was awarded to the J. A. Swingle Co., of Zanesville, O., for $89,316.

Buffalo, N. Y.—The contract for the extension of the Pearl st. pipe line to connect with the terminus at Washington st. was awarded to Fred I. Mumm, of this city, for $6,549.

Parkersburg, W. Va.—This city has awarded contracts as follows: Water pipe, Cantrel Construction Co., of this city, $12,131; hydrants, valves, etc., James B. Clow & Sons, $4,504.

Chickasha, Okla.—The contract for constructing water pipe, setting special castings and hydrants, and the extension of the distribution system, was awarded to C. P. Hollingsworth, of this city, for $8,-369.20.

Colusa, Cal.—Contracts were awarded, Jan. 3, for constructing water works, as follows: To Standard Eng. Co., 503 Market st., San Francisco, for 85 ft. 10-in. c. i. pipe, $1.49; 6,395 ft. 8-in., $1.11; 33,160 ft. 4-in., 56 cts.; 4,320 ft. 3-in., 29 cts., and 1,980 2-in., 18 cts.; wells, $1,270, and fittings on distributing system, $3,136; and to F. C. Roberts & Co., 461 Market st., San Francisco, for pumping station, $9,978, and tank and tower, $6,100; total for entire plant, $47,935.

BRIDGES.

Troy, Minn.—Bids are asked until Feb. 5 for constructing bridges. A. E. Sinks, co. audt.

Yankton, S. D.—Bids are asked until Feb. 3 for constructing bridges. David M. Finnegan, co. audt.

Cleveland, O.—Bids are asked until Feb. 5 for bridge work. John F. Goldenbogen, clk co. comrs.

Oak Harbor, O.—Bids are asked until Feb. 8 for bridge work. W. H. Mylander, co. audt., Port Clinton.

Portland, Ore.—Plans have been adopted by the city council for constructing a high bridge at Broadway st.

Indianapolis, Ind.—The county commissioners have decided to build a number of bridges, at an estimated cost of $400,-000.

Dayton, O.—The citizens of North Dayton have asked the city council to con-

struct a new bridge over Mad river, at Keowee river.

Bloomington, Ind.—Bids are asked until Mar. 9 for constructing steel bridges. Horace Blakely, co. audt.

Duluth, Minn.—Bids are asked until Feb. 8 for constructing steel bridges, with concrete abutments. Odin Holden, co. audt.

West Point, Miss.—Bids are asked until Feb. 8 for constructing a steel trestle. L. J. Howard, clk. bd. supvrs.

Rochester, N. Y.—Plans have been submitted for a reinforced concrete bridge over the river at Central ave., by cy. engr. Fisher.

Chattanooga, Tenn.—The question of repairing McCallie ave. viaduct or constructing an entirely new viaduct is under consideration.

Houston, Tex.—Plans and specifications have been completed for a new bridge across the ship canal, at the foot of San Jacinto st.

Bristol, Va.—Bids are asked until Feb. 8 for constructing a steel or concrete bridge over Beaver creek. Jas. W. Mort, chmn. st. com.

Topeka, Kans.—Bids are asked until Feb. 7 for constructing a bridge across the Shunganunga creek, in Fillmore st. C. B. Burge, cy. clk.

Milwaukee, Wis.—Council has been asked to pass a resolution submitting to vote a bond issue for constructing a new bridge across Milwaukee river.

Shreveport, La.—The city council has adopted an ordinance providing for the construction of a free wagon bridge across Red river between this city and Bossier City.

Columbus, Ga.—The city council has adopted an ordinance calling for an election to issue $100,000 bonds for building a new bridge avross the Chattahoochee river. The election will be held Feb. 16.

Hutchinson, Kas.—(Special). The city commissioners have decided to construct a single, reinforced concrete arch across Cow Creek, at Main and Avenue A. Engineer McLane will prepare plans and bids will be asked for its construction.

STREET LIGHTING.

Bedford City, Va.—Voted to issue bonds for establishing a hydro-electric plant.

Lompoc, Cal.—A municipal electric light plant is advocated.

Montclair, N. J.—A municipal lighting plant is advocated.

Brach, N. D.—The installation of an electric light plant is proposed here.

Newport Beach, R. I.—The citizens voted to install a municipal gas plant.

San Bernardino, Cal.—A municipal lighting and power plant is contemplated.

Lincoln, Neb.—Plans and specifications for a municipal electric light plant have been completed.

Williston, N. D.—Will vote on the issue of bonds for constructing an electric light plant.

Phenix City (Columbus P. O.), Ga.—This city has decided to install a lighting plant.

Albemarle, N. C.—This city has sold bonds for constructing an electric light plant.

Marianna, Fla.—Voted to issue bonds for the consolidation and enlargement of the electric light and water-works plants.

Tacoma, Wash.—Bids are asked until Feb. 21 for constructing the head-works and tunnel for a hydro-electric power plant on the Nisqually river. H. J. McGregor, comr. pub. wks.

Derry, N. H.—The Derry Electric Light Co. is making arrangements to replace its direct-current machines with 3-phase, 60-cycle, alternating-current generators. D. W. Griffiths, chmn.

Chambersburg, Pa.—(Special). The borough council voted Jan. 3 to spend $19,227 more to equip the electric light plant, without submitting the matter to a vote of the people.

Sylva, N. C.—Plans are being made for erecting an electric light plant on the Huckaselgee river, a short distance from Dillsboro, to furnish electricity for this city and Dillsboro.

Lexington, N. C.—Plans are being considered for changing the system of the municipal electric light plant from direct to alternating current, and purchasing electricity for operating the plant from the Southern Power Co., of Charlotte. Albert L. Couch, supt.

Regina, Sask.—(Special). Augus Smith, cy. engr., advises that this city invites negotiations with capitalists and others for the purpose of obtaining proposals for a special franchise for street car services and gas works for the city, subject to the right of the city to take over the undertaking at the expiration of a definite term of years, at a price to be fixed by arbitration, or in such other manner as may be agreed on.

GARBAGE DISPOSAL, STREET CLEANING AND SPRINKLING.

Washington, D. C.—Supt. Wood, of the street cleaning department, recommends the purchase of 3 street washing machines.

Jeffersonville, Ind.—The contract for sanitary carts was awarded to Geo. A. Holzbog, of this city, at $1,340 for five 4-wheel 2-horse carts and at $2,000 for ten 2-wheel 1-horse carts.

St. Louis, Mo.—Contracts for sprinkling the streets were awarded, Jan. 8, as follows: John F. McMahon, Wainwright bldg., 16th district, $7,993; 17th, $6,521; 19th, $5,315; 20th, $6,487; 22d, $3,943; 23d, $2,909; 24th, $4,681, and 25th, $7,183. Frank A. Stiers, 23d district, $3,585; 30th, $6,336; 33d, $4,940, and 34th, $6,199. G. Eyermann & Bro., 1216 South Grand ave., 15th district. $9,200.

PARKS.

Rochester, N. Y.—A park in the 18th ward is contemplated.

Pekin, Ill.—The enlargement of the park between Court st. and Park ave. is proposed.

FIRE APPARATUS.

Bozeman, Mont.—The Gamewell Fire Alarm and Telegraph Co. bid $2,345 for installing a fire alarm system.

Rochester, N. Y.—The contract for installing 3 new joker outfits for the fire alarm telegraph system was awarded to the National District Telegraph Co., for $340 each.

Crockett, Tex.—The contract for furnishing fire hose, reels, pipes, etc., was awarded to the Fabric Fire Hose Co., of St. Louis.

Joliet, Ill.—The council adopted an ordinance, Jan. 3, providing for a high pressure fire protection system to be installed at a cost of $110,000.